APR 3 1913

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXX NO. 13 | SAN FRANCISCO, MARCH 29, 1913 | PER COPY, 25 CENTS

ELECTRIC ENERGY IN THE COEUR d'ALENES.

BY JOHN B. FISKEN.

IRRIGATION FOR PUMPING.

BY E. V. BERG.

PIPING AND AUXILIARIES.

BY C. R. DELANEY.

THE PANAMA CANAL AND FOREIGN OPPORTUNITIES.

BY LINCOLN HUTCHINSON.

APR 5 1913

MATERIALS ADVERTISED IN THIS ISSUE

Batteries
Edison Storage Battery Supply Co.

Boiler Feed Water Treatment
Dearborn Chemical Co.

Electrical Instruments
Weston Electrical Instrument Co.

Heating Appliances
Pacific States Electric Co.
Simplex Electric Heating Co.

Insulator Pins
McGlauflin & Co.

Insulators
Hemingray Glass Co.
"Locke," Pierson, Roeding & Co.
Pittsburg High Voltage Ins. Co.

Mazda Lamps
General Electric Co.

Motors
Century Electric Co.
Crocker Wheeler Co.
Fairbanks, Morse & Co.
Fort Wayne Electric Works.
Sprague Electric Co.

Oil Burners
Leahy Mfg. Co.

Piping
Mannesmannrohren-Werke.
Pittsburg Piping & Equipment Co.

Tool Kits
M. Klein & Sons.

Transformers
Westinghouse Electric & Mfg. Co.

Transportation
Southern Pacific Co.

Turbines.
Pelton Water Wheel Co.

Wire (Trolley)
"Phono," Pierson, Roeding & Co.

Wire
Indiana Rubber & Insulated Wire Co.
Okonite Co.
Pierson, Roeding & Co.
Standard Underground Cable Co.

Alphabetical Index to Advertisers, Page 8. **Where to Buy It in the West, Pages, 9, 10.**

EFFICIENT SERVICE in a business produces permanent satisfied customers —leads to success.

Having and knowing a complete line of goods is as vitally important to giving EFFICIENT SERVICE as is a sales force.

Samovar

NOW

is when the line of

HEATING DEVICES

should be checked up and made complete

Water Heater

The warm summer season, when the true worth of these articles is most appreciated, is fast approaching. Are you in shape to give customers EFFICIENT SERVICE?

There are many useful electric household utensils, of the finest workmanship—durable—strong—short cuts to real living, you should let them know about.

Those pictured here are only a few suggestions —
There are many others.

We will be pleased to mail you catalogue or send our representative to check up and talk over your line with you on request.

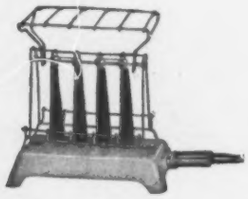
Shaving Mug

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

Distributors for the Pacific Coast

SAN FRANCISCO OAKLAND LOS ANGELES
PORTLAND SEATTLE



Toaster

Disk Stove

THE PACIFIC STATES ELECTRIC CO.
SERVES THE PACIFIC COAST

Chafing Dish

CLB266345

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXX | SAN FRANCISCO, MARCH 22, 1913 | NUMBER 13

[COPYRIGHT 1913 BY TECHNICAL PUBLISHING COMPANY]

ELECTRIC ENERGY IN THE COEUR d'ALENES

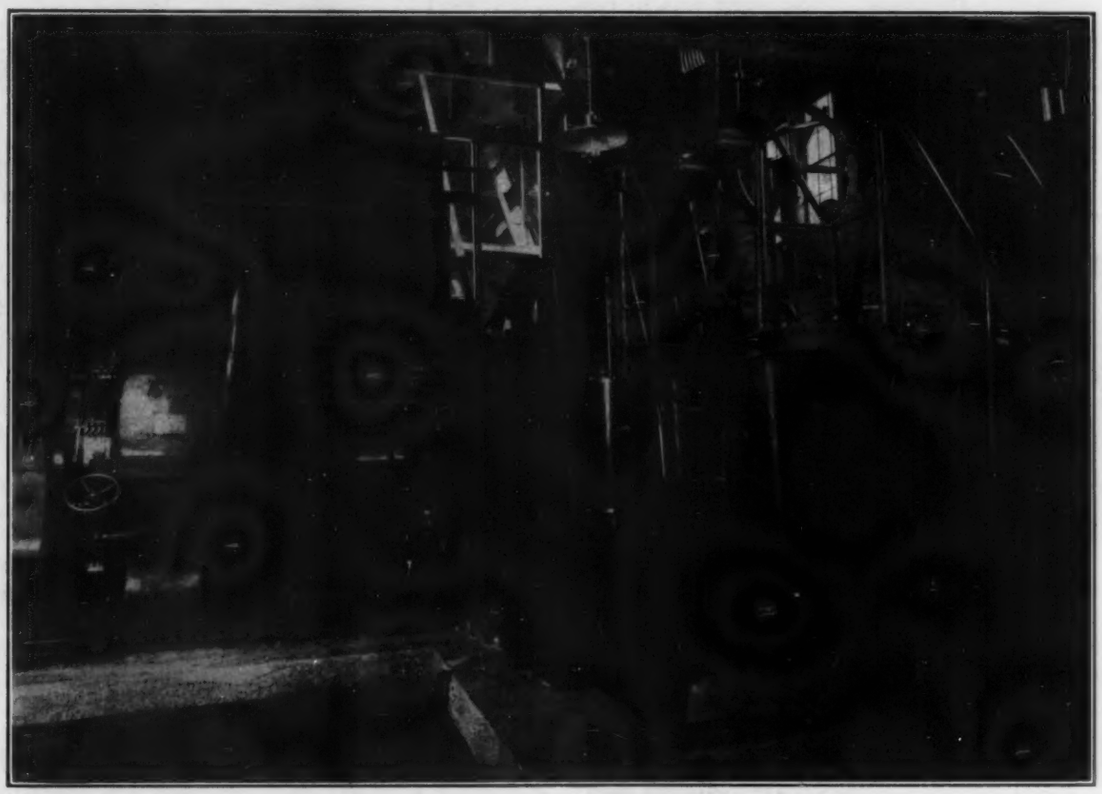
BY JOHN B. FISKEN.

The ignition of charges of blasting powder was the first operation in mining to be accomplished with the aid of electricity. Frequently this energy was furnished by a static machine and occasionally by a magneto generator.

Later this was followed by the application of electricity to bell signals, and we are told that this application was looked upon skeptically and regarded as an expensive experiment by the mining managers of early days.

At the Paris Exhibition of 1878, there was an exhibit of an electric lamp, which suggested future possibilities to mining engineers, and the first successful application of electric lighting to underground excavations, that I have been able to find any record of is that of M. Balvier. In the year 1879 he installed two Serrin lamps and successfully illuminated one of the large underground chambers in the Angers slate quarries.

The first electric mine locomotive of which I have been able to find any record was used in Germany in 1882 in the Royal coal mine at Zaukeroda, in Saxony.



The Hoist of the Hecla Mine.

This application demonstrated that electrical energy could be applied with profit in this phase of mining.

Several years elapsed, however, before any application of electrical energy to mine haulage was made in this country. About 1888 an electric locomotive, for strictly mine use, was constructed by Mr. W. M. Schlesinger of the Union Electric Coal Company in Pennsylvania.

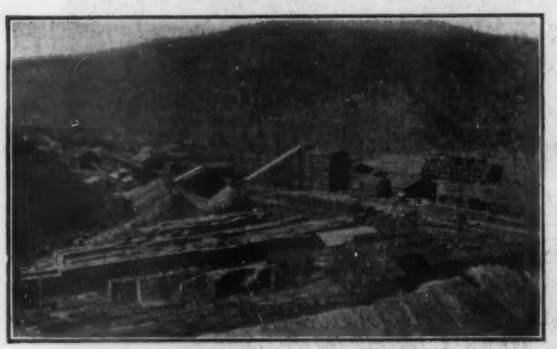
In July, 1888, the first electric hoist to be used successfully in this country, at least, if not in the world, was installed by the Aspen Mining & Smelting Company in their mine at Aspen, Colorado. In this

case the motor was a 7½ h.p., 500 v. street railway motor built by the Sprague Electric Railway & Motor Company. It was used for hoisting on an incline, and the venture was so successful, that another similar outfit was installed in the same year.

The first general application of electrical energy to mining purposes was probably in 1888, when the electric power plant in the Comstock Lode, Virginia City, Nevada, was put in commission. It is interesting to note that in this case there were 6-120 h.p. generators, each generator being connected independently to an 80 h.p. motor, all six motors being belted to the same shaft. The generators were constant current and the motors series wound.

Early Installations iln Coeur d'Alenes.

Let us glance briefly at the history of the early applications of electricity in the Coeur d'Alene country. I believe the first installation was the one for the Last Chance Mine in 1890. This consisted of two Edison bipolar generators of 20 kw. each, operated by water power, which was used to supply a three-wire lighting system in the mine. This plant was in regular operation until 1892, when owing to the mine's indebtedness, it was shut down. The mine itself in 1893 went into the hands of a receiver, and Mr. Robert Cheyne got possession of the lighting plant. He moved it to a point near the dividing line between Wardner and Kellogg, where he operated it with water



Typical Coeur d'Alene Mining Scene.

power under 140 ft. head during high water seasons, and with steam at other times. He sold the plant to the Bunker Hill and Sullivan Company in 1897, who later dismantled it.

The next installation was at the Black Bear mine and consisted of two Edison bipolar generators of 150 kw. capacity. This plant was used for operating Marvin drills, compressor pumps and lights. I have so far been unable to find out when this plant was dismantled or what become of it.

Again we come back to the Last Chance mine in which a second Edison plant was installed with a capacity of 100 kw. This plant furnished power for Marvin drills and lights in the mine and also for lights in Page's Hotel, the Catholic Church, and a few residences. This plant, I believe, passed into the hands of the Bunker Hill and Sullivan Company.

In 1892 there was installed in the power house above Burke, a 250 h.p. Edison bipolar plant of 1200 volts d.c., and the power from this plant was transmitted to Burke where it was used for pumping purposes. This plant was in use until 1898, when the present plant was installed.

In 1896 the first installation at the Standard mine was made and consisted of a 35 kw., a.c. generator and a Thomson-Houston 45 kw., 500 volt generator for operating the mine railway. The latter machine, I believe, is in operation yet, but I do not know what has become of the former.

In 1897 the Bunker Hill and Sullivan Company moved the Last Chance plants which they had acquired to their power house adjoining the mill and in addition installed a 75 kw., 2300 volt monocyclic generator. Water power was used, under 360 ft. head, the water being flumed from Wardner. Later a Russell Tandem Compound engine was installed to help during periods of low water. This was followed in 1898 by the installation of a 55 kw., 550 volt four-pole General Electric generator driven by a hydraulic turbine operating under 46 ft. head. This plant was used during the driving of the Kellogg tunnel and later for general haulage in the mine and about the yards.

In this same year the 1200 v. d.c. plant at the Burke power house was abandoned and a 300 kw. 2300 volt, 40 cycle generator was installed. It will be of interest to note that later the Federal Mining & Smelting Company increased the speed of this machine to get a frequency of 60 cycles and now it is run in multiple with the Westinghouse Water Power Company's plant.

The next installation was made by the Bunker Hill and Sullivan Company, who in 1901, increased the capacity of their lighting plant by the addition of a single-phase 50 kw., 2300 volt generator and a Russell engine similar to the one referred to above.

Modern Electrical Operation.

No further additions were made until August 25, 1903, when the Washington Water Power Company commenced furnishing service in the district and since that time the additions have been too numerous to chronicle.

When the mines were first operated in the Coeur d'Alene district, water power was used to a considerable extent and the heavily timbered hillsides afforded an abundance of fuel when water power was not available. But with the increasing development of the district the necessity of using more water for concentrating purposes and timber for mining the operators were face to face with the alternatives of shipping in coal for making steam or securing electric power from some source.

A group of the operators in the Coeur d'Alene district decided to have electric power, and in furtherance of this resolution Mr. R. K. Neill in behalf of those interested on August 1, 1900, received from Mr. Frederick Post, a deed to the water power, and the necessary real estate at Post Falls.

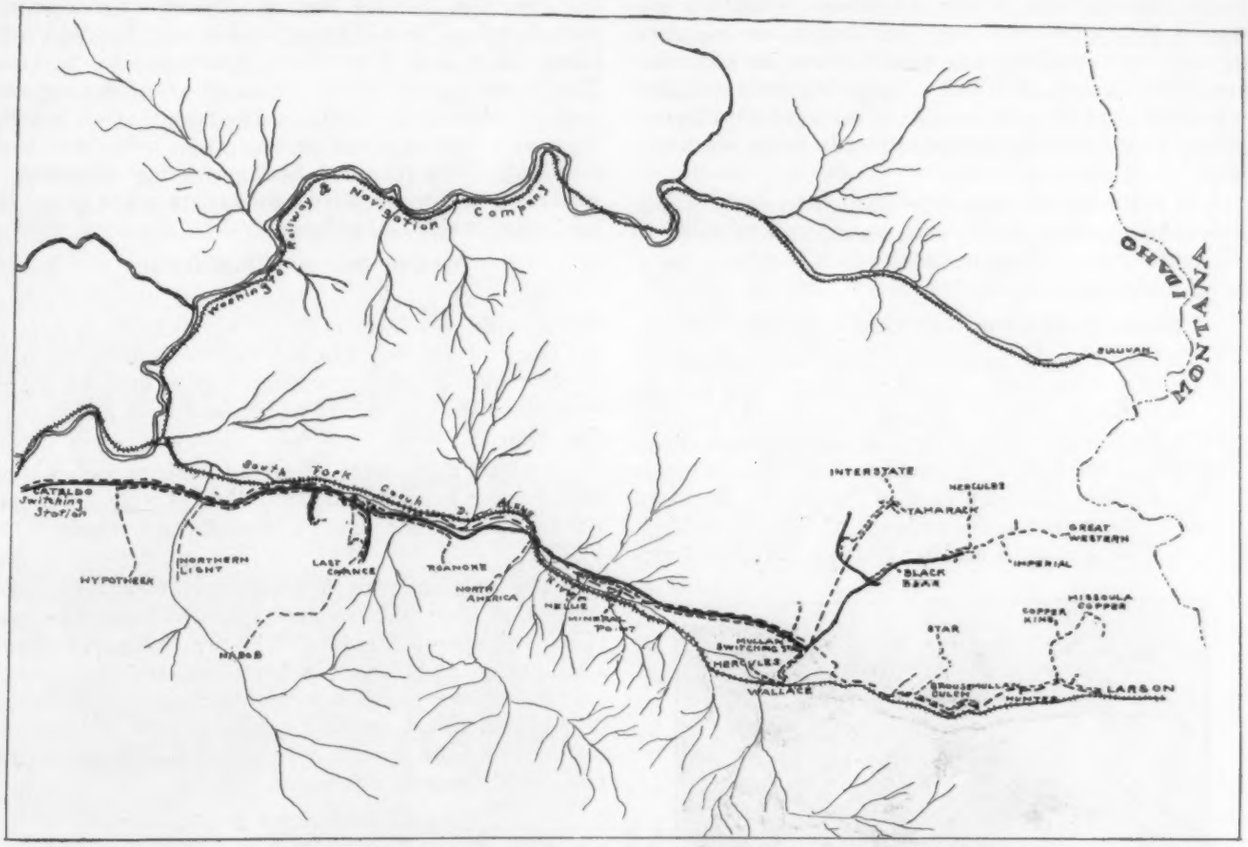
Plans were started looking toward the development of this power, and the construction of a transmission line, but it early became apparent to those interested, that their business was mining, not supplying electric power, and in January, 1902, the Post

Falls property was transferred to the Washington Water Power Company under an agreement that they would supply power to the mines.

No time was lost in carrying out this agreement and the construction of the transmission line was commenced immediately. As it was a physical impossibility to develop the Post Falls power within the time agreed upon, two 2250 kw. generators were installed with the necessary step up transformers at Spokane, and on August 25, 1903, the line was put in commission as far as Kellogg, thus supplying power to the Sweeney Mill, and the Bunker Hill and Sullivan Mine and Mill. Work was then pushed on the remaining portion of the line and early in November the Burke substation at the terminus of the line was put in.

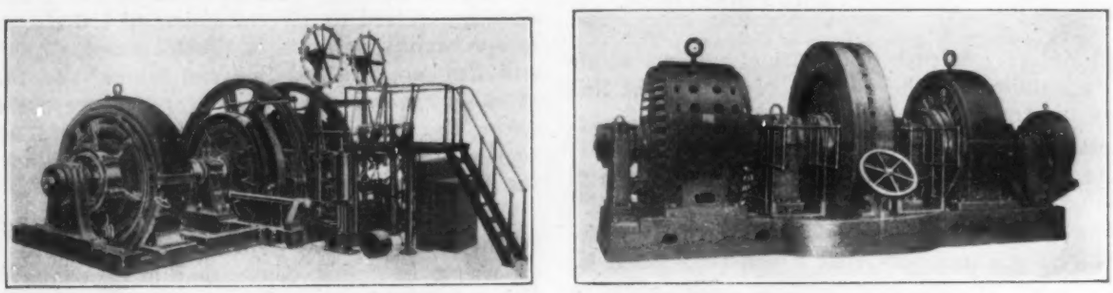
Meantime work had been started on the development at Post Falls and on July 12, 1906, that station was put in commission and run in multiple with Spokane.

It is interesting to note that the transmission line to the Coeur d'Alenes was one of the earliest long distance lines in this or any other country to furnish 24 hours a day regular service.



Map Showing Transmission Lines Feeding the Mines of the Coeur d'Alene District.

The apparatus at the generating and receiving ends and the line were designed for 60,000 volts, but arrangements were made so that the plant could be operated at 45,000 volts. The latter voltage was carried at the start and in fact until February 2, 1905, when the change was made to 60,000 volts, at which voltage it has remained since.



Details of Electric Hoisting Machinery.

In designing the line the problems were all new, and there was an entire lack of any kind of standard construction.

The business grew. In 1907 it became necessary to build an additional line as far as Cataldo. The

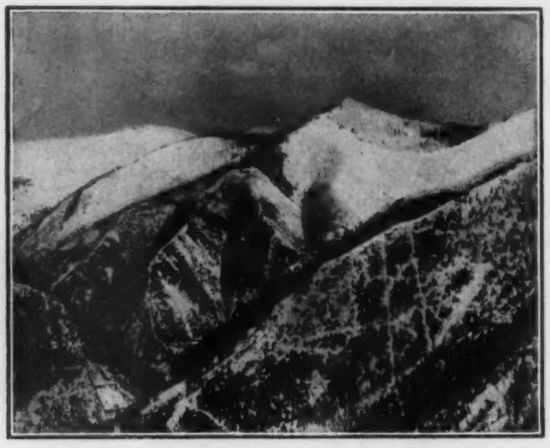
first line was built from Spokane as already stated around the south end of Lake Coeur d'Alene and across the Indian reservation, but the second line was built from Post Falls and the shorter route through the Fourth of July Canyon was followed.

In 1909 the second line was exended from Cataldo to the Sisters Mine, where the present switching station is built. To enable greater facility in transferring the load from one line to the other the switching station at Cataldo, in which oil switches were installed, was built, and air switches were installed at different points to enable the individual loads to be so transferred.

In building the second line which has nearly four times the capacity of the first, an effort was made to eliminate from it those features which had been found to be undesirable in the first line.

Protection of Lines and Quality of Service.

To guard as far as possible from interruptions to the service, these lines are all patrolled once a week and more frequently if necessary. Patrol stations with a patrolman at each station are maintained on each line, at the following points: Post Falls; Opportunity, a short distance east of Spokane; Rockford junction, about six miles northeast of Rockford; Medimont; Wolf Lodge; Cataldo; Kellogg; Mullan Junction and Mullan. At each of the patrol stations an air switch is installed for the purpose of testing the line to locate any trouble that may come on.



Typical Scenery of the Coeur d'Alene Mining District.

Considerable difficulty was experienced at first owing to the lack of inertia in the generating plant. It was found that a mining load was one in which the changes of load were large and sudden. On the other hand it is necessary that a constant speed be maintained for efficient concentration. The memory of the old hoist at the Hecla mine will not be forgotten soon by those who thus endeavored to keep the speed steady.

The speed of an alternating current motor varies almost directly with the speed of the generator and when the Hecla hoist would start at the same time that a compressor picked up load somewhere else, a complaint would be immediately registered from the mill foreman, which was fully justified, as were also the restrictions placed by the Washington Water Power Company on the type of motor to be used for hoisting.

The installation of the splendid apparatus now installed for hoisting at the Hecla did much to relieve the situation, but the best result has come from the fact that the Coeur d'Alene load is now handled from Little Falls and Post Falls, connected in multiple. The stored energy, or fly wheel effect, of the rotating parts in these two plants is so great that all restrictions as to the types of motors to be used have been removed. The plant at Spokane being relatively a small one as compared with the others is not now used for loads outside of Spokane.

Present Status of Substations.

The map gives some idea of the development of the Washington Water Power Company's system in the Coeur d'Alenes. The full line represents the lines as they were in the beginning of 1904, and the dotted lines show the extensions which have been added since that time.

In 1903 there were seven substations with a total transformer capacity of 3350 kw. Today there are eleven substations and a transformer capacity of 13,900.

The original plan followed was to operate each substation from 60,000 volts to 2300 volts and to have them at frequent intervals. The practice now is to install fewer and larger substations and from each substation thus serve a larger territory. This result is achieved by using 6900 volts from the substations and stepping down with open air transformers to 2300 volts at the customer's plant.

Uses of Electricity for Mining.

The uses to which electric energy is applied in mining are many, the principal ones being illumination, milling, hoisting, air compressing, pumping, ventilating, hauling, signalling, firing shots, shop power, etc. Some progress has been made towards reheating compressed air, but this as yet is in the experimental stage. Probably the greatest increase in the future will be in hoisting. In addition to the Hecla hoist already referred to, electric hoists of 150 h.p. each are in successful operation in the Hercules, Gold Hunter and Bunker Hill and Sullivan mines, and the operators of several other mines are at present investigating the subject. This follows as a natural sequence to the greater depth being obtained in mines below the lowest tunnel level.

The facts as set forth in the above description are summarized from my paper presented before the Engineering Societies convention at Spokane, Wash., February, 1913.

ELECTRIC STREET CAR LINE FOR HAWAII.

The incorporation papers of the Hilo Traction Company (Ltd.) organized to equip the city of Hilo with a street car system, were filed at the office of the territorial treasury in Honolulu. The capital stock is $2,000,000, of which $56,000 has been paid in.

ELECTRICAL PUMPING AND IRRIGATION

WASTEWAYS OR ESCAPES ON CANALS.

BY B. A. ETCHEVERRY.

First Type of Sandbox; Sand and Waste Gates on the Amity Canal, Colorado.

This structure was built in 1905. It is interesting because it illustrates some novel features in irrigation design as well as the adaptability of reinforced concrete for structures where plain concrete could not be used. This structure will handle 870 cu. ft. per second which is the maximum carrying capacity of the canal. It consists of regulating gates across the main canal and of waste or sand gates at right angles. Above the regulating gates and in front of the sand gates is a floor built on two levels; over part of this floor is a cover and between this cover and the floor are sand ducts. The height of the sand ducts is 9 in. at inlet and 18 in. at outlet. The remainder of the floor is not covered but is 14 to 17 in. lower than the top of the cover. Only part of the cover over the

Upstream View of Sand Trap on the Amity Canal, Colorado.

sand ducts is permanent, the remainder of the cover being composed of planks made of reinforced cement mortar (1 : 3). These planks may be removed in case of obstruction of the ducts. The planks are 8 in. wide, 1¾ in. thick, reinforced with ¼ in. steel rods. The lengths are 6 ft. 2½ in. and 10 ft. 2½ in. The permanent cover is 2 in. thick and reinforced. The surface of the cover is 6 in. lower than the floor below the gates. This arrangement of the floor and cover is intended to form a stilling place above the gates where the greater part of the sand is deposited. The sand ducts are intended for guiding racks to direct the discharge of the silt towards the sandgates. The cover is necessary to prevent the sand between the racks from being disturbed and picked up as it passes with increased velocity through the regulating gates. This effect will not be felt away from the regulating gates where the floor is not covered.

The regulating gates control the flow of water in the main canal. They consist of three openings, 12 ft. wide, separated by buttresses 10 in. wide supporting the reinforced concrete operating platform. The maximum depth of water above the gates is 6 ft. Each opening is closed with a gate which has the form of a segment of a circle and revolves around a horizontal shaft to which it is attached by means of a frame built up of steel angles. The gates are raised with a worm gear hoist. The sand gates are similar in design and consist of two openings 10 ft. wide. The maximum pressure on the gates closing these openings is 8 ft. 5 in. The advantage of this form of gate is that the lifting force depends very little on the water pressure as the resultant water pressure passes through the shaft on which the gate is hung and the lifting force is equal to part of the weight of the gate, plus the force necessary to overcome the axle friction (which is very small) and the friction of the gate on the buttress. To make the gates water tight, the bottom of the gate rests on a wood cushion and to the sides of the gates rubber belting is fastened which bears on the steel sliding plate, bolted to the buttress wall. The water pressure presses the rubber belting tightly against the buttress wall. These radial gates permit a wide opening which is advantageous when, as in this case, the water in the canal is liable to carry ice, that with narrow openings would cause ice jams. The face of these gates is built of reinforced concrete ¾ of an inch thick. The reinforcement consists of ¾ in. expanded metal No. 13 fastened to the steel angles of the frame by means of U bolts.

The foundation of this structure consists of 12 in. concrete piles resting on sandstone, three under each buttress wall of the regulating gate, two under the floor above the regulating gates and one under the floor below the sand gates. Supported on these piles are reinforced concrete beams on which rest the floor. To prevent undermining the sheet piling at the upstream end, the concrete walls at the downstream end extend from the floor to the impervious sandstone stratum. The structure contains 230 cu. yds. of concrete, consisting of 95 cu. yds. of reinforced concrete and 135 of plain concrete, and required 1151 cu. yds. of excavating. The itemized cost of this structure was not obtainable. The total cost is as follows:

Excavation, concrete work, backfilling complete	$4,160.08
Structural steel for radial gates	953.52
Hoisting devices for radial gates	275.00
	$5,388.60

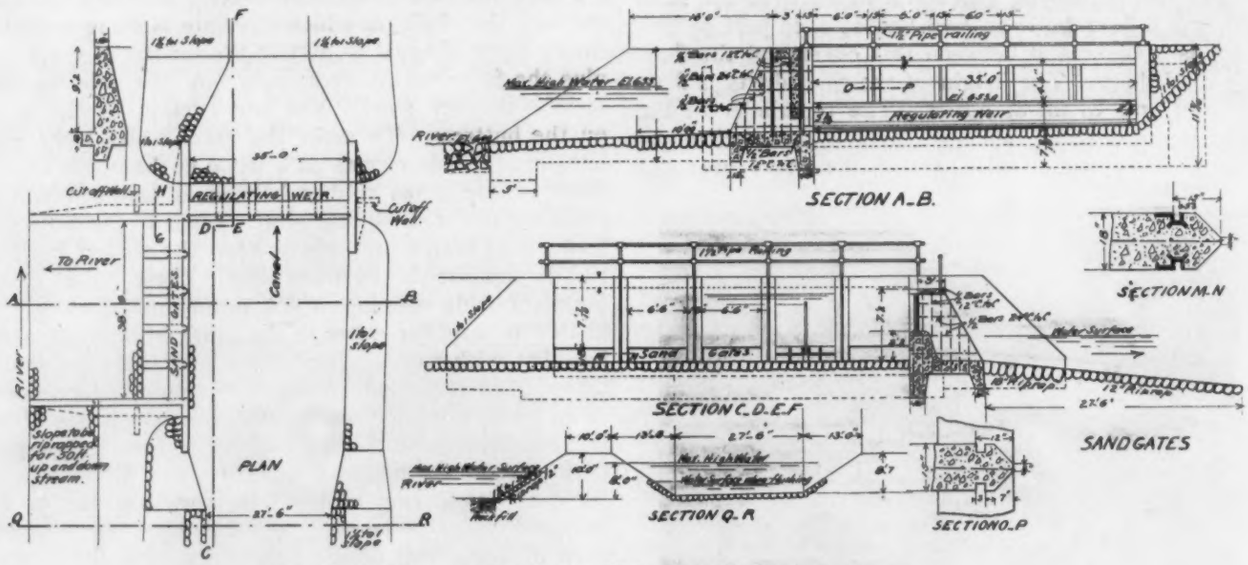
Second Type of Sand Box.

This type of sand box consists of the settling basin, sluice gates, and the waste canal. The settling basin may be of the following three forms:

1. A section of the canal is enlarged sufficiently to obtain a low velocity which will permit the deposition of silt and scouring gates are placed at the lower end of the section. They must be placed sufficiently low to obtain a high velocity through them and must be of sufficient capacity to produce a scouring velocity

in the canal. The scouring effect is greatest just at the gate and diminishes with the distance upstream. For that reason a long section of canal is not necessary or desirable. The sand gate is often placed at a short distance below the headgate and it is possible to increase the scouring effect by forcing through the section when the escapes are opened a volume greater than the full normal capacity of the canal. A structure of this type is the Umatilla sandgate and wasteway described further.

2. The settling basin is formed by depressing the floor of the canal and enlarging the cross section for a length of canal much shorter than in the form described above. The sluice gates are placed at the lowest point of the basin. The sides and bottom are generally lined with concrete and in some cases warped



Sand Gates and Regulating Weir, Umatilla Project, Oregon.

inlet and outlet wings are necessary to obtain a gradual change in velocity. The length of the basin should be at least four times the depth of water in the canal and preferably more. With this form of basin the scouring effect of the gates is concentrated in the basin.

3. The settling basin or box is similar to the second form but is subdivided into a number of compartments separated by overflow walls placed at right angles to the axis of the canal. The water enters into the first compartment, passes over the overflow walls into each one in succession and deposits sand and silt which is flushed out through sluice gates placed at the lowest point of each compartment. This form of basin has been used in many cases in southern California where it is desired to remove the sand and silt before passing water into pipes used for irrigation or power. For small volumes of water this form of settling basin is probably the most efficient. An example is the sand box of the Hemet Land & Water Company, Riverside, Cal., described further.

Umatilla Sand Gates and Wasteway.

This structure is 1300 ft. below the headgates and is intended to regulate the flow of water in the main canal and to keep the silt out of the main canal below. It consists of a regulating weir and gates across the main canal and a set of sand gates at right angles, adjacent and upstream of the regulating weir. The sand gates discharge in the river which is parallel to the canal and very near it. The crest of the regulating weir is about 3 ft. higher than the bottom of the canal above the weir and about 5.8 ft. higher than the bed of the canal below the weir. This forms a stilling body of water above the weir, where sediment is deposited. The sand gates are on the same level as the canal and permit the flushing out of the silt. The regulating weir is designed for 300 second feet and consists of 5 openings 6 ft. wide, separated by reinforced piers 15 in. wide and regulated by flashboards. The sandgates consist of five gate openings 6 ft. 6 in. wide and 18 in. high, separated by piers 18 in. thick. Above the gate opening and between the piers are panel walls or curtain walls 12 in. thick reinforced with ½ in. bars. On top of the piers is the operating platform with hoisting device for the five cast iron gates. The foundation is in gravel. Wing walls and cut off walls project 4 ft. below the bed of the canal. The canal and river bed and banks are protected with riprap.

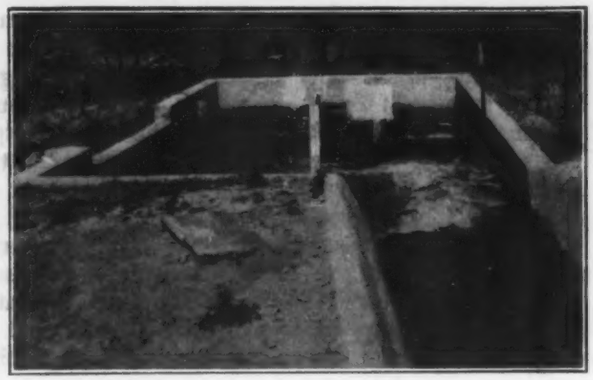
The freezing weather and the high water in the river increased the cost of construction, seepage water standing to a depth of 2 ft above the bottom of excavation. The concrete used was mixed in the proportion of 1 :2.5 sand :5 gravel.

The cost of construction is as follows:

	Actual quantity.	Unit cost.	Total cost.
Excavation	219 cu. yds.	$2.74	$ 601
Concrete (excluding cement)	268 cu. yds.	6.83	1,830
Steel reinforcement	1,900 lbs.	.033	63
Cement	338 bbls.	2.17	733
5 C. I. gates and guides	762 lbs.	.074	564
5 hoisting devices	3,425 lbs.	.14 2/3	503
Setting iron and steel	12,945 lbs.	.004	43
Pipe railing			201
Riprap	318 cu. yds.	5.86	1,863
Rock fill, river bank	209 cu. yds.	1.24	259
			$6,660

Sand Box of Hemet Land & Water Co.

This box is divided into three compartments. The water is brought to the box in a cement concrete lined canal and after passing through the three settling basins separated by partition walls, flows over the measuring weir into the pipe. By removing the



Sand Box, Hemet Land and Water Co., California.

flashboards indicated on the drawing and closing the entrance to the stilling basin, the water may enter the pipe directly. This may be necessary in case of obstruction of the flushing out gates. The floor of this box is built of boulders cemented together and the walls are built of concrete.

References:

1. Collapsible dams and scouring sluices.
   Paper No. 1—Smart's Shutters.
   No. 2. Automatic Waste Weir Gates at Bhatgar reservoir.
   No. 3. Automatic Waste Weir Gates of Lake Fife.
   No. 4. Falling Shutters on the Paricha Weir.
   No. 5. Khanki Weir Shutters. (The Irrigation Conference, Simla, 1904, Office of the Superintendent of Government Printing, Calcutta, India).
   The Las Vegas Irrigation Project, New Mexico, by H. H. Barnett, Eng., Rec., Oct. 8, 1910.
   Movable dams, flood gates. Chapter XXV, Water Power Engineering, by D. W. Mead. McGraw Publishing Co.
2. Fishways and logways.
   The Camere System of Fish Ways installed in the dams of the Rivers l'Hyeres and l'Aulne. Annales des Ponts et Chaussees, part IV, 1903.
   Fishways and Logways. Chapter XXV. Water Power Engineering, by D. W, Mead. McGraw Pubilshing Co.
3. Headgates and Gate Hoists. Chapter XXV. Water Power Engineering, by D. W. Mead. McGraw Publishing Co.
4. Spillways.
   Siphon Spillways on the Champlain Canal. Engineering Record, Oct. 8, 1910.
   A Reinforced Concrete Spillway with Concentrated Crest Length, by D. W. Murphy, Engineering News, Sept. 9, 1909.

PROPOSED ENLARGEMENT OF ELECTRIC-SUPPLY PLANT FOR CANADIAN CITY.

The city of Birmingham is considering an increase of the electric light facilities at a cost of almost $5,000,000. This money would not be spent at once but as needed to meet the demand for electric current.

IRRIGATION FOR PUMPING.[1]

BY E. V. BERG.

Included in a pumping system are the pump station, the pipe lines and the canal distribution system with headgates and measuring devices. While the discussion will hold for any kind of pumping units, the writer has confined himself to the electrically driven centrifugal pump combination, which is the usual style of mechanical irrigation unit in this State.

There are two methods of power charge in vogue —the meter rate with a fixed minimum and the flat rate. Both ways of charging have advantages though the meter rate is apt to be more favorable to the consumer. The feature of the meter rate, is, of course, that you pay for just what you use. It gives the operator a chance to economize, to take advantage of moist springs and rains during the growing season and by watching the water users pumping may be regulated so that there is no needless waste of power. In most cases, the landowner or power user is not the power owner, but must buy the current which runs his machinery from some private power company. This power cost is usually the main item of expense in operating a pumping project. On the flat rate basis, a seasonal charge of a certain amount per horsepower is made figured on a certain short time maximum of power used during the season. In certain cases where the majority of the acreage is in cultivated crops, like fruit, potatoes, corn, beans, etc., it may be possible by early watering and much cultivation to keep the peak load down, but in case the tract is set to diversified crops, such as grain and alfalfa which are not cultivated and which must have a large amount of water during the hot weather, the peak is bound to be high. However, whatever the method of charge, the power bill is always the largest item of expense, and therefore in order to keep down the total cost all parts of the system should be designed with great care so that operation may be conducted with the greatest efficiency in every particular.

An attempt will be made to show briefly what some of the elements are that make for efficiency. In an analysis of the losses which are chargeable to the pumping system, it is necessary to begin at the low tension or meter side of the transformers. The wiring and switch loss between transformer and motor in a properly designed plant is negligible and need not be considered. Passing then to the motor, whether induction or synchronous, we find that for practically all standard makes a certain high degree of efficiency has been reached. For motors of 100 h.p. 90 per cent is usual, while for sizes above 500 h.p. 94 per cent or 95 per cent is not uncommon. This appears to be about the limit of efficiency to be attained in this kind of a machine, including as it does, all mechanical and electrical losses. Alternating current motors are made to run most efficiently at one speed and when running at full load, and any appreciable variation in speed or load is made at the expense of efficiency. The electric motor for pump drive is ideal. It is simple and reliable and has a high efficiency. The centrifugal pump has not yet attained the effi-

[1]Delivered before the Fourth Annual Convention of the Idaho Society of Engineers.

ciency, but in simplicity and reliability is a worthy partner of the motor. Water, being material and having inertia, is accompanied by more losses when passing through a pump than is the corresponding flow of current through a motor and hence pump efficiency is lower than that of motor. Some of the losses which contribute to a decreased pump efficiency will now be reviewed. One of the sources of mechanical loss is poor stuffing box design. A roughly made or short box will allow air to enter or water to escape from pump, unless the gland is drawn up very tight and packing compressed to such a degree as to heat. The only other place where mechanical friction comes into play is in the bearings. These should be ring oiled and the babbitt properly grooved to distribute the oil uniformly over the whole length of the journal. In case thrust bearings are required a proper pressure balance on the impeller or special provision in the bearing itself must be made. The mechanical losses are frictional and incident to all machines. The hydraulic losses are more complicated and are peculiar to the centrifugal pump and the water turbine. They are due to friction and shock, shock being caused by changes in velocity at the various points of passage through the pump.

The suction intake should be of ample size and whatever bends or elbows are necessary should be of long radius. On entering the impeller, a sudden increase in speed takes place, and some degree of churning, causing a small loss of power at this point. If the impeller is constructed according to proper design, the blades are few in number and as short as possible for the given speed. The metal should be smooth and blades curved in such a way as to give the greatest hydraulic radius at every successive point in passing through the impeller, i.e. the water cross section as compared with the wetted perimeter should always be a maximum. Under these conditions the friction and shock losses will be a minimum. Upon leaving the impeller and before entering the guide vanes, is a space only a fraction of an inch in width, somewhat similar to the air space between rotor and stator in the induction motor. Water under pressure passes through this space and back into the suction chamber to be repumped. The loss at this point in a carelessly made machine may be considerable, but where proper workmanship is applied the loss is small.

In entering the guide vanes, if there are any, the water is directed so as to cause the smallest loss due to cross currents and eddies which would be likely to occur if the water entered the casing directly. The guide vanes and casing should be built so that the change from velocity head to pressure head at pump discharge shall be as gradual and uniform as possible, which will then convert the largest per cent of velocity into pressure head.

The sum of all the losses in a good pump amounts to about 25 per cent of the power input on the shaft. This would represent an efficiency of 75 per cent. In special cases or where unusual refinement was attained 80 per cent or even 85 per cent has been reached. As these figures correspond with the best turbine efficiencies, it would seem that the limit has practically been reached for this kind of a pump.

In the general plant layout, economy is promoted, if the total power requirement is divided into several medium sized units instead of one or two large units. This is done to supply the necessary water at the various seasons, without running a large machine when only a small amount of water is needed. In case there are two lifts but all the machinery in one building, it would tend toward economy to have one unit designed for the high lift, but only about one-half the size of the remaining units. The piping could be so arranged that by manipulation of the valves, discharge could be either in the high lift pipe or in the low lift pipe. This scheme of pumping into one or the other of the ditches would be advantageous for early spring or late fall stock and domestic water.

The next link in the chain is the pipe which conveys the water from the pumps to the canal or reservoir at the upper level. For a given amount of water the efficiency of any pipe is directly proportional to diameter and inversely proportional to length. A pipe would be 100 per cent efficient if it had no length or if it were infinite in diameter. The length of the pipe is a fixed condition and is determined by the contour of the ground for any given elevation, but the diameter may vary within wide limits. In fixing the size of pipe we can resort to the same methods used in determining the size of its electrical analogy, the transmission wire. In the latter case, either of two methods are applied, viz: Kelvin's Law, in which the interest on investment is made to equal the cost of the losses, or, a certain arbitrary loss in per cent of total power is allowed and size calculated to conform to that condition. The first of the two methods would be applied something as follows: compare two sizes of pipe in total cost of installation then figure interest on the total cost and depreciation on the material cost only. The sum of these two items for each pipe gives the comparative money value of the investment. Now, the larger pipe will, of course, show the greater cost but will also show the greater efficiency. If the increased efficiency of the larger pipe indicates a greater power saving than the extra interest and depreciation cost, then the larger pipe is the one to adopt. According to the other system a certain per cent loss is allowed in the pipe and the size calculated therefrom. The writer has used a method which seems reasonable and satisfactory, as follows: Allow 3 per cent loss in pipe for first 3000 ft. of length when pipe is carrying one-half its full load capacity, and allow 1 per cent in addition for each additional 1000 ft. in length. The reason for using one-half the maximum is that this is roughly the average amount of water carried during an irrigation season. Thus for example, a wood pipe is to carry a maximum of 20 sec. ft. to a height of 40 ft. Since power required is directly proportional to head, a loss of 3 per cent would be equivalent to adding on to total head 3 per cent of itself or in this case, 1.2 ft. Now this 1.2 ft. is available to be used up by friction and velocity head and it is found that for a 1000 ft. length a 26 in. pipe will carry the required 10 sec. ft. for a pipe 2000 ft. long this allowable loss must be distributed over twice the former length and it is found in this case that a 30 in. pipe would be required. Likewise a pipe between

2000 and 3000 ft. long would have the same given losses distributed over three times the length and a 32 in. pipe would be required. When pipe exceeds 3000 ft. it is found that adding 1 per cent allowable loss per 1000 ft. is sufficient to take care of the additional loss and the size of pipe remains the same as for 3000 ft. length. According to this system, pipes for low head figure out larger than pipes for higher heads, which is as it should be, since high pressure and smaller pipe is about the same price as low pressure but larger pipe.

The next item in the irrigation scheme is the ditch system. The proper laying out of the ditches is very important since it would be useless to have great machinery refinement and then allow canal losses which are to a great extent avoidable.

The writer is a believer in parallel canals. This, not only for the reason that it is more economical to pump to different elevations, rather than all the water to one high elevation, but from the fact that each of the parallel canals, except the upper one, will catch any waste there may be off of the land immediately above. It is true that two parallel ditches would cost more to construct and the seepage and evaporation losses might be a little greater, than in the case of one large canal of the same capacity, but this extra cost and extra losses are compensated for, in that fewer laterals need be constructed to bring the water within specified distance of the land to be watered. The canals should be built with the largest hydraulic radius practicable for the given grade as this will insure the least seepage and evaporation losses. Concrete lined canal wood pipe or oiled canal would add greatly to the efficiency of the system as the losses from seepage would be reduced to a minimum and in the case of concrete lining, or wood pipe, the ditch maintenance cost would be almost eliminated. There may be cases, where the concreting of a canal right at the beginning, expensive though it be, might be an actual saving when total cost of project is considered, for approximately half the yardage would be saved over an earthen canal and the saving in water might be sufficient to warrant a great reduction in size of pumping plant, pipe lines and other works. An important part of the ditch system are efficient and accurate measuring devices, so that the ditch rider may know to a certainty how much water each irrigator is getting. It seems to be human nature that a man will take as much of a thing as he can get, and this is true of irrigation water, even if he has to waste it to get rid of it. This seriously interferes with the economical operation of a pumping system and the best way to prevent it is by the use of proper measuring devices.

Under a pumping system, a certain measure of control should extend over the landowner's operations. Anything that may add to the economical use of the water after it leaves the main, or as they are usually called "company ditches" should be impressed on the farmer. Each farm should be required to be properly laid out as to head and waste ditches, direction of furrows or corrugations, etc. It has been thoroughly demonstratetd that runs should not be over 400 ft. or 500 ft. long between head ditch and waste ditch, for the most economical duty of water and this practice should be advocated. There could be some regulation as to location of various crops on a farm, i.e. those requiring a large amount of water to be at upper end of farm nearer the source of supply and below the cultivated crops which require less water and can utilize whatever waste there is off of the upper field.

On the tract with which the writer is connected, it is believed that a system of maintenance and operation charge will be tried whereby a certain fixed sum, probably about 2/3 the total estimated cost of the season, will be charged against every acre of land whether in crop or not, and the excess to be charged to those actually using water and in proportion to the amount used. In this way a careless irrigator would have to pay for his wastefulness, while a good irrigator would be rewarded by having a less maintenance fee to pay.

Pumping for irrigation is a success. There is no longer any doubt about the machinery or the steadiness or quantity of water which can be supplied, but these things are attained at a greater cost than is the case under gravity flow. In order to make up or compensate for this disadvantage, greater refinement and knowledge must be applied in growing crops. If crops can be raised by close application to right principles which will yield a few dollars, more to the acre than anywhere else, the disagreeable extra operation cost has been overcome.

COST OF POWER TO MEET TACOMA BONDS.

BY. A. L. THORN.

Cost and Selling Price of Energy per kw.-hour at Various Annual Load Factors.

Per Cent Load Factor	Cost of kw.-hr. in Cents. Steam.	Water.	Selling Price Per kw.-hr. Water.
15%	1.54	1.52	2.44
20%	1.33	1.21	1.95
25%	1.12	0.92	1.46
30%	1.01	0.74	1.18
35%	0.93	0.64	1.02
40%	0.89	0.57	0.90
45%	0.85	0.52	0.83
50%	0.81	0.46	0.75
55%	0.78	0.42	0.68
60%	0.75	0.39	0.60
65%	0.74	0.36	0.55
70%	0.7250	0.3350	0.48
75%	0.71	0.31	0.48

Note:—These values are based on the assumption of a fixed annual charge of $13.60 per kilowatt plus an output charge of 0.5 per kw. hour for the steam plant and a fixed charge of $20 per kilowatt of demand on the water power plant.

In the last column is shown the price, at which energy from the hydroelectric plant must be sold in order to produce a profit of 6 per cent on the investment.

Fixed Annual Charges of Steam and Water Power Generating Plants.

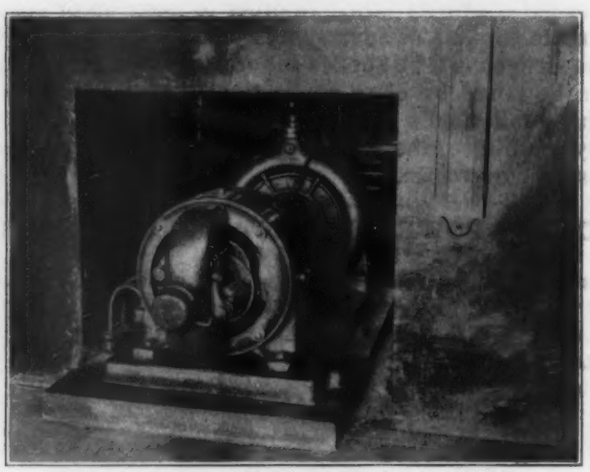
Item.	Per Cent Total Investment. Steam.	Water.
Interest	6.00	5.00
Insurance	0.50	....
Taxes	0.50	0.50
Depreciation	5.00	1.00
Obsolescence	5.00	1.50
	17.00	8.00

ELEMENTS OF STEAM POWER PLANT DESIGN

PIPING AND AUXILIARIES. V.

BY C. R. DELANEY.

In designing a steam plant the size of the piping must be very carefully thought out. If the steam pipe carrying the steam from the boilers to the turbine, is too small there may be considerable drop in pressure and as a drop in pressure of 10 lb. results in an increase of 1 per cent in the steam consumption, this is something that must be avoided if possible. On the other hand, the steam pipe must not be made too large as this will cause waste of heat by greater radiation from the pipes; furthermore, the cost of the larger pipes, valves and fittings must be considered. The size of the circulating water pipes is also an important item. In some cases the power required to



Motor Driven Circulating Pumps. The Use of Electric Motors Prevents Escape of Exhaust Steam From the Roof.

force the circulating water through the condenser amounts to 3 per cent of the total output of the turbine. While a great deal of this is due to the friction through the condenser itself, there is often much more friction than is necessary in the pipe lines, and by installing larger pipes the amount of power to move the circulating water could be cut in half, resulting in a saving of 1½ per cent. While the saving of 1 or 1½ per cent appears to be trivial it must be borne in mind that if a 12,000 kw. plant is operated continnously anywhere near its full load, this saving of 1 per cent would amount to over $5,000 per year.

It is customary to operate all the pumps and all the other auxiliaries of the plant non-condensing, and make use of the exhaust steam from them to heat the feed water and the fuel oil. If the plant is properly operated no exhaust steam should appear blowing away from the roof. There is usually no difficulty in attaining this, as when there is a fair load on the plant, the exhaust steam from all the auxiliary machines is not enough to heat the feed water much over 150 degrees. Some gain in economy may be effected by taking enough steam from the first or second stage of the turbine for use in heating the feed water; this, however, involves complications to the piping which are not warranted in the case of an auxiliary steam plant. When the load is light, there is usually more exhaust steam than can be used, and if the plant is to operate at light loads much of the time, it will pay to install electrically driven pumps instead of steam driven.

In designing a steam plant as an auxiliary to a water power transmission system, it is not as important to install the most economical machinery as it would be if the system depended entirely on the steam plant for its power. The extent to which economical machinery should be installed will depend mainly on the length of time it is expected to operate the auxiliary plant during the year. If the plant is merely a stand-by plant and is to carry no load except for short periods once or twice a year, then the efficiency of the plant when in operation is of very little importance. If on the other hand, as is usually the case, the plant is expected to carry a fair share of the load throughout the year, then the efficiency of the plant is of very great importance.

The main difference between an ordinary central station steam plant and a steam plant which is an auxiliary to a transmission system, is in the operating end. Sudden demands for power are liable to occur at any time and the stand-by plant must always be ready to pick up the load and carry it as long as may be required. To keep in readiness for these emergencies it is necessary to have several boilers cut in on the line and if the load is not heavy enough to use the steam from all these boilers, they must be fired one after the other for a few hours at a time so that they will all be hot and in readiness for a sudden demand for steam. Steam turbines operate automatically. If a sudden load is thrown on the station the automatic governor on the turbine immediately opens the valves and lets more steam into the machine to take care of the increased load. The first indication that the men in charge have of a sudden load coming on, is that the steam pressure begins to drop. Then all hands rush to the boiler room, light the oil fires and get all the available boilers in commission. The steam pressure may drop 15 or 20 lbs. but as long as the limit of capacity of the machine at this lower pressure is not exceeded, the turbine will maintain its speed, and as soon as all the boilers are in commission the pressure will recover, and the plant will run along at the increased load as if nothing had happened.

THE PANAMA CANAL AND FOREIGN OPPORTUNITIES.

BY LINCOLN HUTCHINSON.

With the passing of the first ship through the Panama Canal a new era in international trade will have been inaugurated. By 1915, the year of the official opening, the results of the great changes in trade routes will have begun definitely to make themselves felt; a new and broad opportunity will have opened itself before the growers, manufacturers, and merchants of the United States and Europe.

The mere opening of the canal, however, will not in itself produce an expansion of trade. It will only provide an opportunity for development, and this opportunity will be seized upon by all peoples who are eager for trade. Success in the international rivalry thus promoted will depend upon the degree of preparedness which the competitors are able to show and the earnestness with which they pursue whatever advantages they may hold.

The chief exporting nations which are to be affected are the United States and the larger commercial nations of Europe. Most important among the latter will be the United Kingdom and Germany, for they have the greatest interests in the trade whose conditions are to be modified by the opening of the new route. Important also, but to a less degree, will be France, Belgium, Italy, Spain, and Russia. Holland and Austria-Hungary also contribute to a small extent to the trade with China and Japan.

On the other side of the equation will be the lands which provide a market for the goods of the abovementioned countries—the importers of American and European goods. They naturally fall into two distinct classes: (1) Those which are so definitely within the zone of of influence of the Panama Canal thtt the trade routes to them from the eastern United States and Europe must of necessity be via the new waterway; and (2) those so situated that even after the completion of the canal there will be alternative rival routes still open for use. To the former class belong the countries of the west coast of South America, the west coast of Central America, Mexico, the United States, and British Columbia, and the Pacific islands. The second class will include New Zealand and Australia, the Philippine Islands and the Orient generally, with increasing influence of the canal as one passes up the Asiatic coast to Japan.

Requisites to Successful Use of New Route.

The first prerequisite to success in making use of the opportunities which are to be opened is a clear recognition of the limitations of the new route. Only certain countries, whether they be the American or European exporting nations or the South American, Australasian, or oriental importing ones, are likely to be affected, and these in differing degrees.[1]

The second prerequisite is an intelligent knowledge of the trade and trade conditions of the lands whose markets are to come within the influence of the new waterway. The trader in America or Europe who best understands the character and quantity of goods which the markets are demanding and the ability of the various exporting countries to supply those demands will be the best position to profit by the new developments.

Countries to Be Affected by Opening of Canal.

For the purpose of this comparison, the importing countries in any degree affected by the opening of the canal are taken to be: Chile, Bolivia, Peru, Ecuador, Colombia, Costa Rica, Nicaragua, Honduras, Salvador, Guatemala, Mexico, New Zealand, Australia, China, Japan, and the Philippine Islands. Panama and British Honduras, are omitted, the former because its trade has been so abnormal during the construction of the canal that the figures can form no reliable index of what the future is to be, and the latter because, having no frontage on the Pacific, it does not come within the direct influence of the canal. Of the East Indies, only the Philippines are included, because the others are regarded as being almost exclusively within the zone of influence of the Suez Canal.

The only European countries which send any considerable quantity of exports to any of these lands are those already mentioned in an earlier paragraph—the United Kingdom, Germany, France, Belgium, Italy, Spain, and Russia. They, with the United States, are the only ones which can be said to be, in any marked degree, competitors for the trade.

During the five years 1907-1911, these eight countries exported to the 16 purchasing countries mentioned, merchandise to the average value of $717,200,000 per annum. This is a very considerable business and it is increasing rapidly. If we compare the five-year period 1907-1911, as above, with the two preceding five-year periods we shall find that in every one of these countries and groups of countries there is steady growth of purchasing power, with the single exception of China. In the latter's case the decline in recent years is readily accounted for by the political crisis through which that country has been passing and the inflation of its imports during the Russo-Japanese war which made purchases abnormally large during the second period, 1902-1906.

American and European Exports to Purchasing Countries.

The following table gives the European and American exports of merchandise to the countries named, in annual averages for five-year periods, the values being stated in millions of dollars:

		1902-1906		1907-1911	
Exported to.	1897-1901.	Value.	Increase over first period.	Value.	Increase over second period.
Central America and Colombia	23.3	27.8	19.3	33.3	19.8
Mexico	48.9	77.0	57.5	92.4	20.0
Bolivia, Chile, Ecuador and Peru	41.4	63.6	53.6	90.3	42.0
China (including Hongkong)	82.7	146.8	77.5	136.9	6.8
Japan	73.3	89.3	21.8	113.5	27.1
Philippines	8.9	14.8	66.3	22.6	52.7
Australia, New Zealand, Fiji, etc.	153.7	166.6	8.4	228.2	37.0
Total	432.2	585.9	35.6	717.2	22.4

It will be noticed that the rate of increase between the second and third periods (22.4 per cent) is somewhat less than that between the first and second periods (35.6 per cent). This is caused by the low increase in Mexico (20 per cent) and the slight decline in China (6.8 per cent) due to unusual conditions in these two countries. A recovery may be expected before long, and the grand total by the year 1915, the date of the official opening of the canal, will unquestionably be at least a billion dollars.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Rialto Building, San Francisco

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., of Journal of Electricity, Power and Gas, published weekly at San Francisco, required by the Act of August 24, 1912.

Name of	Post-Office Address.
Editor, Robert Sibley	Rialto Bldg., San Francisco
Managing Editor, Arthur H. Halloran	Rialto Bldg., San Francisco
Business Manager, E. B. Strong	Rialto Bldg., San Francisco
Publisher, Technical Publishing Co	Rialto Bldg., San Francisco
Owners—	
E. B. Strong	Rialto Bldg., San Francisco
A. H. Halloran	Rialto Bldg., San Francisco
Robert Sibley	Rialto Bldg., San Francisco
R. J. Davis	54 Natoma St., San Francisco
C. L. Cory	Nevada Bank Bldg., San Francisco
A. M. Hunt	Nevada Bank Bldg., San Francisco

Known bondholders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgages or other securities, none.

E. B. STRONG.

Sworn to and subscribed before me this 20th day of March, 1913.

(Seal.) J. W. COOK,

Notary Public in and for the City and County of San Francisco, State of California.

(My commission expires December 20, 1915.)

On Library Cars of all Southern Pacific Trains.

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.25

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1890.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Electric Energy in the Coeur d'Alenes 287
By John B. Fisken.

Electric Street Car Line for Hawaii 290

Wasteways or Escapes on Canals 291
BY B. A. Etcheverry.

Irrigation for Pumping 294
By E. V. Berg.

Cost of Power to Meet Tacoma Bonds 295
By A. L. Thorn.

Piping and Auxiliaries 296
By C. R. Delaney.

The Panama Canal and Foreign Opportunities 297
By Lincoln Hutchinson.

Editorials 298
World-Wide Commission Regulation.
Electricity in Mining.
Cost of Power.

Personals 300

Meeting Notices 300

Examination for Deputy Inspector of Electricity 302

New Electrical Installations 302

Industrial 303
Storage Battery Cars in California.
An Electric Commuter.
An Old Sawmill Electrified.
New Features Added to Cutler-Hammer Drum Type Controllers.

News Notes 305

News of California Railroad Commission 306

World-Wide Commission Regulation

Citizens of the Pacific Coast states have abundantly indicated in recent months their firm confidence in commission regulation of public utilities. Washington, Arizona and California first took the lead, while Oregon is at present perfecting her commission organization and the state legislatures of Montana and Idaho have just enacted splendid legislation looking toward reasonable commission control. Though the idea of commission regulation is a child of recent birth, so far as Western agitation is concerned, yet it has amply demonstrated its right for existence when properly constituted. A commission fostered by citizens of high ideals and composed of men of integrity with a goodly mixture of brains, brings about results that may well be courted by corporation and people alike.

The utility regulation idea has now grown beyond the bounds of state or even national confines. To the student of progress, it is not difficult to see in present international tendencies a faint beginning or demand for regulation of public utilities, international in its sphere of action. As an instance we cite the Panama Canal. This project represents the nerve and daring of a brave people, a nerve and daring backed by sums of money so stupendous in their outlay as to record a high-water mark for similar national projects of the world's history.

No matter how the facts may ultimately develop in the protest of Great Britain over proposed or supposed discrimination in canal rates, we can not but recognize in this protest an embryo germ for public utility regulation. The age ahead is unquestionably one of far reaching upheaval against all that savors of unscientific and uneconomic development, a protest against special privilege and unregulated monopoly. To produce the world's supply of human necessities at the least cost of human effort is the slogan ahead.

The commission regulation idea first became manifest in the municipal struggle on the part of the people against those controlling the necessities of life—heat, light, water and transportation. In California this idea has grown into state control, which now justly proposes to exert its influence to curtail the unreasonable rates in proposed sales of water even by a city to its surrounding neighbors, maintaining with perfect justice that the people when operating public utilities themselves, have no more right than private corporations to "charge all the traffic will bear."

While we believe the present state of evolution in regulation is perhaps unprepared to grapple with the stupendous task of regulating international outrages in unconstrained monopoly, yet it is a fact that the growth of international commerce is becoming so dovetailed with daily human existence as to demand such a commission at an early date.

From statistics published on another page of this issue, it is seen that the sixteen countries affected by the opening of the Panama Canal purchase in foreign supplies over $717,200,000 per annum, forty-nine per

cent coming from Great Britain, twenty-eight per cent from the United States and thirteen per cent from Germany.

The countries bordering on the Carribean Sea use millions in supplies that may be produced in Pacific Coast states. As pointed out by Secretary Knox in San Francisco some months back, Western men will find in this territory a splendid new field of endeavor. Electrical supplies and engineering talent are even now going forth in ship loads from Western ports to many of these new opportunities. Any regulation either in commerce or public utilities must perforce deeply affect Western enterprise.

Many argue that the Hague Tribunal is the proper place to refer such regulation. If this is true, experts clothed with ample power should be employed to properly constitute such a world-wide effort. Since, then, an international regulation commission must come sooner or later, it is to be hoped that the broadest possible range of action may be read into its constitutional powers.

Electricity in Mining

It is interesting to note how different mining communities have solved the uneven jerks in load, due to sudden calls for power in the electrical operation of mines. The concentration of ores for most efficient results requires an even, steady speed from the operating mechanism. The hoist or haulage system suddenly put in motion, compounded with the heavy and fluctuating demands of the air compressor, have consequently made many a mill foreman's life anything but a bed of roses.

In the Butte mines the construction of a central compressed air storage system thus allowing the compressors to operate continuously and under steady load conditions, has worked out a remarkably even load factor for the hydroelectric system driving them.

In the great Coeur d'Alene mining district of Idaho, on the other hand, an equally commendable scheme has been devised. This territory is largely served by the Washington Water Power Company. Due to the effects of the highly inductive load experienced in this distributing network and the consequent overheating of the generating apparatus, this company was one of the first to penalize mining companies for their low-power factor. This was largely accomplished by putting a clause in the contract that power should be sold on the basis of kilovolt amperes indicated instead of kilowatt consumption of electrical energy. In addition, heavy restrictions were put upon the type of motor to be used in the hoisting apparatus. Thus at the Bunker Hill and Sullivan mine in 1908 an interesting evolution in auxiliary mining apparatus was experienced. During the previous season this company had purchased a steam turbine to assist a direct connected hydraulic unit during low-water season and at times of excessive air compressor operation. After a series of tests it was found more economical to actually cease operating the steam turbine as a prime mover. Thus the turbine was allowed to "float" on the line and the power factor of the load was wonderfully bettered. This was one of the first instances of this practice, which has now become quite general throughout the West.

Not only has the Bunker Hill and Sullivan thus aided in the general power factor improvement, but many of the other mines, too, are wonderfully assisting. Thus the new apparatus at the Hecla, where sudden hoisting fluctuations are traditional, has materially improved the entire district. As in the many-plant hydroelectric networks of California, however, the most good has been accomplished by the inertia or flywheel effect felt from the Little Falls and Post Falls plants operating in multiple, thus adding their combined steadying characteristics.

It is surprising, too, to what extent modern electrical applications have invaded the mining field. While the mining engineer always prefers to purchase his electrical power since he is in the mining business rather than electrical generation of power, still in the operation of his mill and mine its uses are manifold. Thus, beginning with the sole use of the electric spark for blasting back in the sixties, modern mining finds electricity indispensable for illumination, milling, air compressing, pumping, ventilating, hauling, signalling, firing shots, shop power and electrolytic assaying with a hundred other possibilities in sight for the near future.

Cost of Power

On another page of this issue may be found the engineer's estimates of the minimum prices at which hydroelectric power may be sold at Tacoma in order to pay interest on outstanding bonds.

One illuminating point stands out most brilliantly in reviewing this tabulated data; namely, that the load factor plays a most important role. Thus, it is seen that when operating on a load of 15 per cent of the total installed capacity the sales from power must average 2.44 cents per kw.-hr. On the other hand could a 75 per cent load factor be maintained an average income of as low as 0.48 cents would pay bond interest.

Again, in casting the eye over the engineer's estimates for steam as opposed to hydroelectric power, interest charges, insurance, taxes, depreciation and obsolescence all total 17 per cent for an annual charge in the case of the former compared with only 8 per cent for the hydroelectric installation.

It is true that in the Tacoma plant the permanence of the construction is a great factor in reducing obsolescence and depreciation, still it is doubtful if 1 per cent for depreciation and 1.5 per cent for obsolescence is anywhere near sufficient charges to allow for these important items, no matter how permanent the structure may be.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

W. I. Otis has returned from a business trip East.

W. M. Deming, sales manager for the General Electric Company, is at San Francisco.

L. N. Peart, superintendent of the San Joaquin Light & Power Company, is at Sacramento.

Leo Kelly, engineer for the Home Telephone & Telegraph Company, of Los Angeles, is at San Francisco.

G. B. Ochiltree, an official of the Pacific Telephone & Telegraph Company, is in San Francisco from Los Angeles.

S. H. Anderson, electrical engineer for the Pacific Electric Railway Company, is a recent San Francisco visitor.

B. F. Pierson, general superintendent of the Southern California Edison Company, is a recent San Francisco visitor.

W. L. Porterfield, president of the United States Long Distance Telegraph Company, is an interested San Francisco visitor.

Norwood W. Brockett, secretary of the Northwest Electric Light and Power Association, is visiting California from Seattle.

E. Podden, president of the Oakdale Power and Light Company of Oakdale, Cal., was at San Francisco during the past week.

Wm. S. Heger Jr., manufacturers' representative at San Francisco, was married to **Miss Adelaide Gregg** at Milwaukee, Wis., on March 24.

F. W. Hoover has resigned as industrial agent of the Southern Pacific Company to take care of the E. W. Clark electric interests at Chattanooga, Tenn.

J. L. Hoke, superintendent of the Pacific Light & Power Corporation. is visiting the central cities of California, including Oakland, San Francisco, and Sacramento.

T. N. Boyer, assistant manager Chicago office General Electric Company, and Mrs. Boyer, were in Seattle for three days recently, returning from a pleasure trip to California.

C. M. Bliven, agent in charge of the Seattle branch General Electric Company, is in San Francisco on a ten days' business trip. In his absence G. E. Swett is in charge of the office.

E. R. Northmore, secretary of the Los Angeles Section of the A. I. E. E., and superintendent of electric distribution for the Los Angeles Gas & Electric Company, is a recent San Francisco visitor.

H. R. Olson, assistant treasurer of the Pacific States Electric Company at Portland, and **F E. Wilson,** assistant treasurer of the same company, located at Los Angeles, are spending a few days in San Francisco.

Carl Bush, formerly with the Western Electric Company as telephone specialist and assistant sales manager, has been made assistant general manager of the A. G. Electric & Manufacturing Company of Seattle.

J. E. Macdonald, secretary of the joint pole commission of Los Angeles, has been called upon recently in Oakland, California, to render valuable advice looking toward the solution of distribution difficulties in that city.

J. A. Spears, illuminating engineer with H. W. Johns-Manville Co. at San Francisco, was married to **Miss Irene Bibb** at San Francisco, March 25, **Hal Lauritzen,** Pacific Coast manager of the Holophane Company, being best man.

H. V. Carter, president of the Pacific States Electric Company, has recently returned from a ten days' trip through Southern California. He reports things brisk in the south and eastern arrivals at the rate of 2000 a day being brought into that section by the railroad companies.

A. J. Quigley, sales engineer of the A. G. Electric & Manufacturing Company with head offices at Seattle, has returned from a two-weeks trip through eastern Washington, calling on the trade at Spokane, Walla Walla, Moscow, Idaho, Tacoma, North Yakima and Ellensburg. He reports conditions throughout the state as very encouraging.

Theo. F. Dredge, manufacturers' representative at San Francisco, has returned from a visit to the eastern factories. While at Chicago he arranged a most successful informal dinner for the Consolidated Engineering Company at the Great Northern Hotel. Co-operation, the subject of the meeting, was fittingly exemplified by the California wine companies who supplied all liquid refreshments without charge.

B. W. Collins, manager of the Northwestern Supply Company and the Pacific Lamp & Supply Company, 707 Commerce street, Tacoma, has been made superintendent of electric works for the city, a position formerly held by him under present Commissioner Lawson. After retiring from the position he spent some time in Alaska and Idaho in mining and hydraulic work. The management of the designated companies was taken over the first of the year. Mr. Collins formerly resided in California, where he was general superintendent of the Monterey County Gas & Electric Company. **A. L. Thorn,** present superintendent of the city's electrical interests, has taken over the commercial management of these interests and will devote his time to the sale of current for power, light, heating and cooking.

R. F. Hayward, Chairman, Western Can. Pr. Co., Ltd., Vancouver, B. C.; **E. M. Breed,** Secretary, Allis-Chalmers-Bullock Co., Ltd., Vancouver, B. C.; **J. R. Read,** Canadian Westinghouse Co., Vancouver, B. C.; **L. C. Robinson,** British Col. Elec. Ry. Co., Vancouver, B. C.; **A. C. Routh,** Northern Elec. & Mfg. Co., Vancouver, B. C.; **F. D Nims,** West. Can. Pr. Co., Ltd., Vancouver, B. C.; **E. R. Northmore,** Los Angeles Gas & Elec. Cor., Los Angeles; **J. E. Macdonald,** 444 Pacific Elec. Building, Los Angeles, Cal.; **G. R. Murphy,** Rialto Building, San Francisco, Cal.; **A. H. Halloran,** Journal of Electricity, Power & Gas, San Francisco, Cal.; **H. R. Wakeman,** Ry., Lt. & Pr. Co., Portland, Ore.; **J. B. Fisken,** Washington Water Power Co., Spokane, Wash.; **J. B. Ingersoll,** Spokane Club, Spokane, Wash.; **C. F. Terrell,** Puget Sound T. L. & P. Co., Seattle, Wash., and **M. T. Crawford,** Puget Sound T. L. & P. Co., Seattle, Wash., have been appointed by President Mershon, members of the Pacific Coast Convention Committee of the American Institute of Electrical Engineers for 1913.

ELECTRICAL DEVELOPMENT AND JOVIAN LEAGUE.

The regular weekly meeting was held Tuesday, March 25th. Among other matters considered was the appointment of a committee empowered to investigate fully the present city ordinances regulating the opening of streets by public service corporations and power companies, and the relation of the latter concerns thereunder, and upon completion of its findings to present same before the board of supervisors of San Francisco in an endeavor to have the present chaotic condition with respect to this question remedied.

The subject of the day—"The Storage Battery as a Business Getter"—was ably and interestingly presented by Mr. Geo. Murphy of the Electric Storage Battery Company.

A. I. E. E. DIRECTORS' MEETING.

At the regular monthly meeting of the board of directors of the American Institute of Electrical Engineers upon March 14th, upon the request of the executive committee of the committee on organization of the International Electrical Congress, San Francisco, 1915, a resolution was adopted, explicitly authorizing the said executive committee to organize the congress, to determine the scope of the papers, to arrange for the publication of the proceedings of the congress, and to arrange the entire program, as implicitly au-

thorized previously. Authority was also given for the expenditure of certain sums from the Institute treasury, to cover the cost of carrying out the work referred to above.

The report of the tellers' committee's canvass of the nomination ballots cast for candidates for the Institute offices falling vacant on July 31, 1913, was read. The board then made up its list of "Directors' Nominees" as provided in Section 31 of the Institute constitution, with the following result: For president, C. O. Mailleux, New York; for vice-president, M. H. Barnes Jr., New York, J. A. Lighthipe, Los Angeles, Cal., Charles E. Scribner, New York, W. S. Rugg, New York; for managers, B. A. Behrend, Boston, Mass., P. Junkersfeld, Chicago, Ill., H. A. Lardner, San Francisco, Cal., Lewis T. Robinson, Schenectady, N. Y., Charles Robbins, Pittsburgh, Pa. It will be noted that the board of directors placed on its list of directors' nominees four candidates for the office of vice-president, three of whom are to be elected, and five candidates for the office of manager, four of whom are to be elected.

Oregon Technical Club.

W. L. Brewster, a member of the board of directors of the Library Association of Multnomah county, addressed the club on March 18th, regarding library conditions. J. Andre Fouilbaux presided as chairman. W. H. Crawford and Mr. Curry were appointed on the Rose Festival Committee. Governor West is expected to address the next luncheon on "The Celilo Project and the Old Columbia Southern Reclamation Enterprise." The April 1 meeting will be presided over by Mr. E. A. West of the P. R., L. & P. Co., and he announces as speaker the eminent French bridge engineer, Emil Barnhart, also as a special added attraction the Metropolitan Quartette, and Mr. Schulizh, a recent student of Paderewski.

Oregon Society of Engineers.

At the regular monthly meeting, March 13th, Mr. C. E. Fowler lectured on "Deep Foundations." A committee was appointed to report on a summer trip to Eugene, Oregon. A suggestion of a union of Portland, Seattle and Spokane engineering societies presented by Mr. C. E. Fowler, was discussed. A code of ethics was introduced and referred to committee. Mr. C. F. Stevens of Barcelona, Spain, caused to be presented in his absence, a paper on "Influence of Forest on Climate and Stream Flow." The paper was read by title and ordered printed, when it will be read in full and discussed. At a previous meeting President W. H. Graves announced the following committee appointments: Jas. R. Thompson, chairman membership committee; Wm. S. Turner, chairman by-laws committee; C. F. Blake, chairman library committee; H. L. Vorse, chairman program committee; Orrin E. Stanley, secretary, chairman employment bureau committee.

Portland Jovian Luncheon Club.

At the luncheon March 20th, C. P. Osborne was chairman and a very spirited debate was participated in, by Messrs. C. J. Franklin and E. A. West on the negative, and A. S. Moody and W. F. McKenney on the affirmative, on the subject of "Should Jovianism Endorse Woman's Suffrage." The judges were Messrs. C. L. Wernicke, J. B. Goodwin and J. E. Davidson. The judges rendered a unanimous decision in favor of the negative. The attendance was 60. During the month of April the chairman will be F. D. Weber, electrical inspector Underwriters' Equitable Rating Bureau, Portland, Oregon. The following program has been arranged:

April 3.—Capt. T. B. Steele, U. S. A., "Personal Reminiscences of Thomas A. Edison as a Business Man."

April 10.—Mr. M. G. Hopson, U. S. R. S., supervising engineer, "Conflagration Hazard of Portland."

April 17.—Mr. D. C. Henny, consulting engineer, "The Highest Dam and Largest Reservoir in the World."

April 24.—Mr. Eugene Brookings, President of the Progressive Business Men's Club of Portland, "The New Commission Charter."

ELECTRIC CLUB AT MEDFORD, ORE.

The Electric Club, composed of members of the California-Oregon Power Company, held its monthly meeting on Friday evening, March 7, in the company's club rooms at Medford. Mr. J. D. Sinnott was chairman pro tem for the evening and placed a (1) before March 7 to remind the club that this meeting should have been held on Ireland's day. Tables were set in the club rooms and a "Peak Load" lunch was served starting at 6:30 p. m. The table decorations consisted of a large Shamrock whose leaves covered white paper cups containing salted peanuts and green wafers and butter cups. The menu was a "Peak Load" card, listing: Oyster stew with salted crackers, a la "Walther." Sardine sandwiches with 'high tension" mustard. "I Scream" with cake, like the customer with a "Light Bill." "Flat Rate" coffee, "Excited" with cream. "Westinghouse" cigars with "G. E. Lighters."

Mr. George R. Sailor of the Westinghouse Electric & Manufacturing Company, acted as toastmaster for the evening. The roll follows:

J. D. Sinnott, chairman (speaks English, Irish, Latin and Westinghouse).
L. G. Fear, R. A. Balzari, T. R. Jump, Geo. R. Sailor, W. M. Bernie (all from the We-Sting-House).
O. B. Helt (from the Gee Yee Company), D-Quid is on your trail.
H. L. Walther, (Here, there, everywhere,—Swears a little).
Sidney Sprout, ("Often consulted").
H. C. Stoddard ("Statistics"—Cat. No. 23, Page 15, Line 7.)
O. G. Steele, (Some swift—at any old job. No pushee,—No pulle, Go-ee-like-Hell-ee).
T. G. Bradley, ("Hatless dispenser of Lead Pill").
A. C. Hough, (Ounce of preventive, worth a pound of cure").
R. W. Clarke, ("Very much just so, so").
G. J. Walton, ("Can't join any more lodges").
C. A. Malone, ("Irish Politician").
E. E. Ebell, (Dollars and sense—Figgers. Loud Reports).
F. F. Loder, "Now you see him, now you don't").
J. J. Butcher, ("Bing, Bang, Biff, Jerk").
W. H. Sears, ("C. O. P. Comedian and Cartoonist").
C. W. Martin, (Dignified gent who never sleeps, a-la-Edison,—Just works).
Don Colvig ("Just Papa").
M. Stephens, ("Printer—chews horseshoe").
F. C. Chamberlain, (Superintendent Fobes Supply Co., Religious Department).
O. O. Alenderfer, (Sells you something, then makes you deliver the long green).
A. B. Cunningham, ("He who worries—Nix").
C. G. Ware, (Doesn't mind draughts. Rain and storm cut no ice-prints by Arc).
F. O. Stinson, (His swear word, "Oh, my Goodness")
H. C. Purucker (Whoop-ee! Kee-Hoo! Hear him 7 blocks).
Walt Randle, (The Mushroom King from Grants Pass).
B. O. Wilkinson, (Plays Arkansas Traveller fine on the Fiddle).
R. C. Curry, ("The Stove I Built")
Clyde Dean, Cupid Chaser—Young yet.
C. S. Cole, (Mud-slinger—with the old Buick).
E. G. Henselman, ("Sherlock Holmes").
C. G. Conwell, (Diplomat (?)),
E. G. Darnielle, ("One of my men"—G. B. C.)
Herbert Alford, (Scene shifter for the Magic Lantern).

TRADE NOTES.

Davis & Hull, 942 Commerce street, Tacoma, have the contract for installing the wiring in the $40,000 hotel building to be erected by the Pacific Malting & Brewing Company at Ruston, Washington.

The Standard Engineering Company, 273 Colman building, Seattle is now purchasing material for the installation of a lighting system at Boise, Idaho. Ornamental posts will be used and 215 arc lights installed with underground wiring.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

EXAMINATION FOR DEPUTY INSPECTOR OF ELECTRICITY, PORTLAND, ORE, DEC. 10. 1912.

1. (a) Does a condenser in an alternating current have the effect of increasing or decreasing the resistance? (b) What is meant by a non-inductive load?

2. (a) What are the chief units of electrical measurements? (b) By what term is electric power designated? (c) Can a current of large amperage alone do work? State fully. (d) How is the amount of electrical energy usually expressed?

3. (a) If a motor is taking 75 amperes of current at 220 volts, what horsepower is it giving, the efficiency of the motor being 90 per cent? (b) If a 450 watt lamp takes ¾ ampere current what is the voltage of the line?

4. A generating plant supplies 76 h.p. of current at 110 v. (a) How many amperes is it furnishing? (b) How many 16 c.p. lamps at 3.6 watts per c.p. would it supply?

5. What is the code requirement for the testing of the insulation of new code wire? State fully.

6. If you had a 2-wire, 200 volt, direct current circuit supplying 1-50 h.p. motor and 1-20 h.p. motor, for what current capacity would you have to select your conductors? Give work.

7. Why does the code insist upon the two or more wires of an alternating current system being placed in same conduit?

8. (a) What character of fuses must be used for very heavy currents such as 1000 amperes? (b) Why are they selected for such currents? (c) Why does the kind of fuse used depend on amperage and not on voltage? (d) What is the first essential before there can be a flow of an electric current?

9. (a) What is Ohms law? (b) What is meant by the term "circular mil."? (c) How would you figure the carrying capacity of wires? (d) What is meant by the term "kilowatt hour?"

10. Explain the Edison 3-wire system.

Electrical Wiring and Apparatus.

What are the Underwriters' requirements for:

(1) the connection of exit lights in theaters, auditoriums, etc.?

(2) the installation of lamps and sockets in rooms where inflammable gas may exist?

(3) the use of flexible cord? State at least five of such requirements.

(4) the installation of resistance boxes, rheostats, and equalizers? State fully.

(5) outline lighting on buildings, (other than signs on exterior)? State at least five of the requirements.

(6) for the installation of metal cabinets? State how they are to be constructed.

(7) for the installation of electric fixtures? State at least five code requirements.

(8) (a) Where would you require conduit to be installed in the city of Portland? (b) Explain clearly under what conditions wooden moulding would be permitted in Portland.

(9) Give the requirements of the proper installation of concealed knob and tube work.

(10) (a) How many circuits may be carried in the same conduit? Would you permit the installation of two different systems in the same conduit? Why? (b) How many outlets may be permitted on a circuit in the following places: offices, stores, show windows, residences, signs?

Practical Questions.

1. (a) At what point in the mains should branch circuits be connected? (b) Give an illustration by diagram of a proper and of an improper connection of branch circuits to mains.

2. (a) Draw a diagram of two shunt wound generators coupled in series showing shunt coil, ammeter, rheostat, fuse and switch connection. (b) Draw a diagram of two shunt wound generators coupled in parallel, showing circuit connections of shunt coils, rheostats, ammeters and switches.

3. (a) What are the principal objections to series motor for single-phase circuits? (b) How can sparking at the commutator be roughly measured? (c) Why should starting boxes always be used with direct current motors? State fully. (d) How are small induction motors started? (e) Why can not the larger sizes be started in the same way?

4. Show by diagram external connections of a single-phase motor, including all connections to primary and secondary circuit as is the general practice.

5. How many volts are lost in a circuit carrying 240 amperes and having a resistance of 30 ohms?

6. (a) What in reality is a three-wire convertible system of electric lighting? Explain fully. (b) In a three-wire system how can one find out how much current the neutral wire is carrying?

7. Explain clearly and fully how you would determine if the wiring in a building is properly installed?

8. Explain and give a diagram showing clearly what constitutes the correct method of wiring for meter loops in the city of Portland.

9. What is the difference between a three-wire and a three-phase system?

10. What type of cord would be required in making extensions to be used in basements or in damp places?

NEW ELECTRICAL INSTALLATIONS.

E. L. Knight & Company of Portland, Oregon, have the new department store building located in Canby, Oregon, to wire. The installation will be in conduit.

The Oregon Furniture Company of Portland is now electrifying their factory and will install about 300 h.p. in motors. They are doing their own installation work.

W. L. Bradley & Company are installing the electrical installation in the new Wadhams & Kerr Building, on the northwest corner of Thirteenth and Davis streets, Portland.

The Waverly Golf Club's new club house at the golf club grounds on the Willamette River, is nearing completion. The electrical installation was done by the Morrison Electric Company of Portland, Oregon.

The girls' dormitory of the State Normal School, Monmouth, Oregon, is nearing completion. The electrical installation was all installed in rigid conduit by W. L. Bradley & Company of Portland, Oregon.

The Inman Oil Company's new plant is being built on the bank of the Willamette River, below Portland, and outside of the city limits. It is fireproof throughout. The electrical installation for both light and power is being installed by the Western Electric Works, Portland, Oregon.

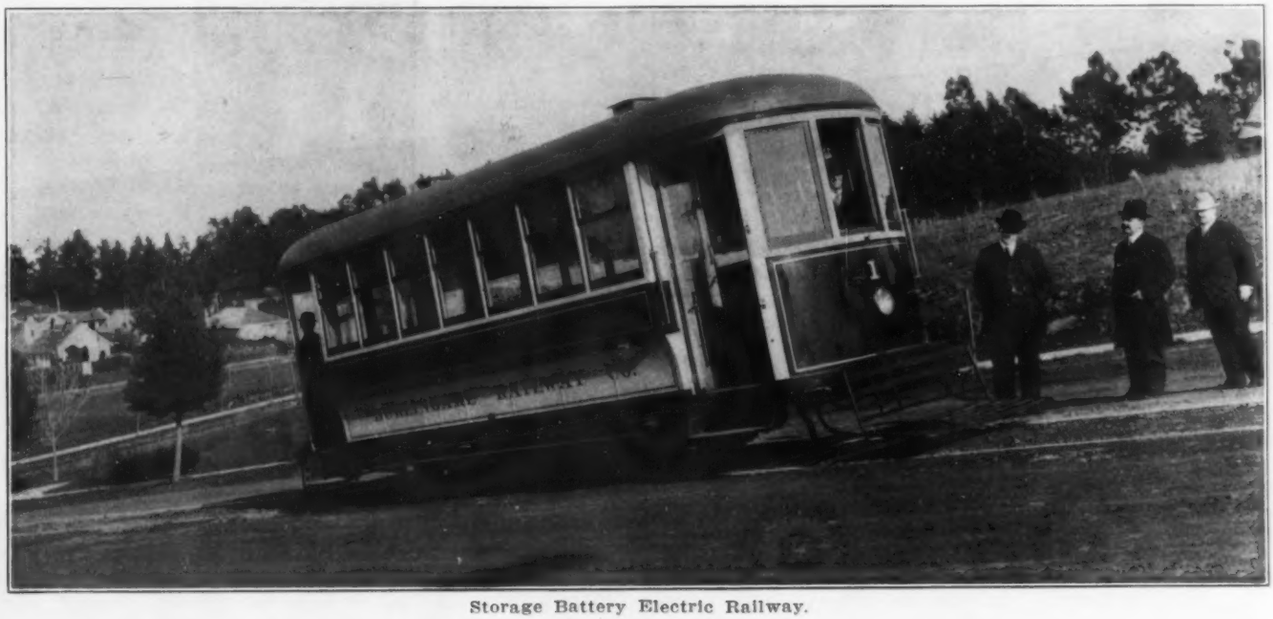
The W. H. Smith Electric Engineering Company of Portland, Oregon, are at the present time doing the electrical work on the following buildings: New University Club, northwest corner Sixth and Jefferson streets; new Broadway Hotel, northeast corner Seventh and Burnside streets; Public Recreation Buildings, Peninsular Park; new Western Union Telegraph office, 126 Seventh street; new Waldorf Billiard Parlors, 334 Washington street.

INDUSTRIAL

STORAGE BATTERY CARS IN CALIFORNIA.

At Easton, near Burlingame, only 30 minutes' ride from San Francisco, there is a new electric car which meets the Southern Pacific trains and carries passengers between the depot and the beautiful homes of the residence district. The little railroad runs out about two miles and makes the round trip in 18 minutes. There's never a sign of a trolley wire, or unsightly poles; no "feed" wires, no "bonding" of the rails so the "juice" can find its way back to the power house, and no cranky trolley pole on top of the car to "fly off," and no "turning the trolley" at each end of the line, leaving the passengers in the dark while the conductor "feels around" for the wire.

The power is furnished by storage batteries under the seats, which are "charged" by a motor generator set whenever it is necessary, while the car is standing at the station, and a comparatively small battery charging plant will charge batteries on several cars in turn just as well as on one car.



Storage Battery Electric Railway.

The batteries on this car are no ordinary batteries, either, but are Edison storage batteries, the result of ten years of hard, earnest, personal labor and experiment on the part of Mr. Thomas A. Edison, the greatest inventor the world has ever known, who felt that nature must afford some further electro-chemical reaction other than a lead sulphuric acid combination. The Edison Storage Battery Company, 818 Mission street, San Francisco, supervised the storage battery installation.

AN ELECTRIC COMMUTER.

At the shrill command of his electric alarm clock John Smith, commuter, sprang out of bed in the grey dawn and switched on the electric light. He hastily washed with electrically manufactured soap. A seasoned veteran of the 7:42 express, he wasted few minutes in dressing, but before he was half clad the water was steaming hot in his electric shaving mug. Dashing down stairs he attacked a rapid-fire breakfast of eggs, electrically boiled, toast electrically grilled, coffee electrically percolated, and cream electrically separated from the milk electrically milked from electrically curried cows. He dashed out of his front door just in time to catch an electrically heated and propelled trolley to the railroad station built of electrically manufactured cement. While waiting for the 7:42 express he lighted an electrically made cigarette with an electrically manufactured match. When the express came buzzing up, Mr. Smith settled down in the smoking car to read his electrically printed morning newspaper.

Arriving in town he descended into an electrically lighted subway through which he was whisked on electric cars safeguarded by electric signals. He ascended to his twenty-story office in an electric elevator and touching an electric button summoned a stenographer with electrically curled hair who operated an electrically manufactured typewriter with electric—

Enough?

But it's not a joke!

One could take John Smith through every minute and hour of his business day, follow him back home again until he turned in for the night—and every minute and hour of that day and night would be made in some way more convenient and comfortable by the marvels of electricity. There are hundreds of thousands, millions of John Smiths in every great civilized country today.

The change has come so gradually that we do not realize what a revolution electricity has wrought in modern life. There are few uses to which electricity is not put in modern industry and up-to-date households. For an infinite variety of work ranging from milking cows to making ice cream, from running sewing machines to washing dishes, from the manufacture of locomotives to the making of wall paper, effective and economical use is now made of electrical apparatus. Recently the Crocker-Wheeler Company made a tabulation of the purposes for which one type only of their motors was used, and the following list includes only a small part of the products electrically manufactured: Automobiles, barrels, baskets, boats, bolts and nuts, boots and shoes, bottles, boxes, bricks, brooms, candles, cans, carriages, cartridges, cement, chains, chairs, cigarettes, cor-

dage, corks, elevators, envelopes, gun powder, hooks and eyes, hoops, ice, jewelry, locomotives, lead pipes, leather, lumber, matches, nails, oat meal, paint, paper bags and boxes, pins, pottery, presses, rivets, rubber, silk, soap, spools, tacks, textiles, typewriters, wagons, wall paper and wire.

AN OLD SAWMILL ELECTRIFIED.

The Liedinghouse Bros.' mill at Dryad, Wash., has just recently been electrified throughout.

The planing mill and back end of saw mill were electrified some years ago. The motors were furnished by the General Electric Company and consisted of the following:

2-50 h.p., 220 volt, 3-phase, 60 cycle, induction motor.
2-35 h.p., 220 volt, 3-phase, 60 cycle, induction motor.
1-25 h.p., 220 volt, 3-phase, 60 cycle, induction motor.
2-20 h.p., 220 volt, 3-phase, 60 cicle, induction motor.
1-15 h.p., 220 volt, 3-phase, 60 cycle, induction motor.
1-7½ h.p., 220 volt, 3-phase, 60 cycle, induction motor.
1-5 h.p., 220 volt, 3-phase, 60 cycle, induction motor.

These motors were rewound for 440 volts.

Power had been furnished by 100 kw. belted alternator and an air Atlas engine, which were discarded and sold.

The new equipment for the sawmill was furnished by the Allis-Chalmers Company and consists of the following:

1-250 h.p., 480 volt, 3-phase, 60 cycle, 720 r.p.m. squirrel cage induction motor, direct connected to a circular head saw. This motor is a two bearing motor, and is the second mill in existence where an induction motor has been direct connected to a circular head saw. The first being at the Ferrybaker Lumber Company, Everett, Wash., this motor being a 300 h.p., 440 volt, 3-phase, 60 cycle, 680 r.p.m. squirrel cage induction motor; the motor being a 3-bearing motor. The capacity of this mill is 250,000 ft of lumber in 10 hours.

1-100 h.p., 480 volt, 3-phase, 60 cycle, 1700 r.p.m., squirrel cage, induction motor is direct connected to an edger.

1-60 h.p., 480 volt, 3-phase, 60 cycle, 1700 r.p.m., squirrel cage, induction motor, belted to a vertical re-saw.

1-50 h.p, ditto; belted to a trimmer.

1-35 h.p., ditto; belted to a slasher.

2-15 h.p., 1-10 h.p., 1-5 h.p., ditto; belted to minor machines.

Steam is furnished by the old boilers which are of the tubular return type; the steam pressure being 100 lb.

Power is furnished by 1-750 kw., 80 per cent p.f. 480 volt, 60 cycle, 3-phase, 3600 r.p.m. Allis-Chalmers Company condensing steam turbine. This unit is equipped with a 42 in. x 24 in. Barometric condenser of the Allis-Chalmers Company manufacture; the motor being supplied by a motor driven 8 in. single stage centrifugal pump, direct connected to 1-50 h.p., 1150 r.p.m., induction motor. There are two 15 kw. exciter units, one driven by a motor, the other belted to a steam engine. The above power is controlled by a 4 panel switchboard of the Allis Chalmers Company manufacture.

The capacity of the Liedinghouse Bros.' mill is 100,000-125,000 ft. per 10 hour day. All the auto-starters are equipped with no voltage and overload release devices.

NEW FEATURES ADDED TO CUTLER-HAMMER DRUM TYPE CONTROLLERS.

Sometimes the location of drum controllers makes operation by a straight backward and forward motion of the operating handle a little more convenient than the usual rotary motion in a horizontal plane. The Cutler-Hammer Manufacturing Company, Milwaukee, has, therefore, standardized a vertical arrangement of lever with bevel gear drive than can be applied to the six direct-current types of enclosed drum controllers and the three alternating-current types. The accompanying illustration shows this straight line drive, the lever having a centering latch released by means of the button at the end of the handle as in the case of the horizontal rotating type lever. The operation is very easy and the milled star wheel and notched lever permit all points of control to be distinctly felt. The construction of the drum, non-

Cutler-Hammer Drum Controller With Vertical Handle.

stubbing fingers, arc deflectors, cylinder, etc., remains as in the original line of controllers which was brought out about two years ago. Special arrangements can also be made for rope operation

NEW CATALOGUES.

"Superheating" is the title of a 16-page pamphlet published by the Heine Safety Boiler Company, St. Louis, Mo., comprising reprints and abstracts of technical papers on the subject.

The engineering department of the National Electric Lamp Association, Cleveland, Ohio, have issued in four-page form a chart designed to facilitate the solution of problems in general illumination. Given the intensity of illumination required, the color of the walls and the dimension of the space to be lighted, by referring to the chart one is able to select the most desirable size of Mazda lamp, and the spacing of units to give satisfactory results.

The General Electric Company has just issued an interesting bulletin (No. A4080) devoted to "Electricity in Excavation and Construction Work." The bulletin deals with both the generating of the current and its use through motors. It touches on the advantages to be derived from the use of electric power, and refers briefly to its application to the work in connection with the Panama Canal, Catskill Aqueduct, New York Barge Canal and in general building construction. Bulletin No. A4073 deals with the Electric Equipment of Bakeries. This bulletin refers to the sanitary advantages of such an equipment, the efficiency, economy of space, convenience, cost, maintenance and reliability, and illustrates the various pieces of apparatus used in bakeries, equipped with electric motors. It refers also to the electric lighting and to electrically heated ovens for bakers' use.

NEWS NOTES

INCORPORATIONS.

LEWISTON, IDAHO.—The Lewiston-Clarkston Valley Railway Company has been incorporated by F. L. Sturm, C. F. Osners, S. L. Alford, J. E. Nickerson, Dr. Morris of Lewiston, J. E. Hoober of Clarkston, and E. S. Florence of Asotin. Capital stock, 10,000 shares, of $100 each.

ILLUMINATION.

FORT MASON, CAL.—Sealed bids in triplicate for installing an eletcric light system at Fort Mason, Cal., will be received here until April 4th.

SANTA ANA, CAL.—The West Coast Gas Company is enlarging its plant and installing a high-pressure system to cost $37,750 for supplying New York Beach and Huntington Beach.

CORONA, CAL.—Sealed bids will be received up to May 6th for the purchase of a gas pipe franchise granting the right to construct and maintain a gas plant and laying of conduits in the public streets of the city.

SACRAMENTO, CAL.—The Sacramento Natural Gas Company has applied for authority to sell $200,000 of bonds, for the purpose of liquidating existing indebtedness for the construction of a new gas holder, for the extension of its pipe line and service pipes, and for drilling new wells.

QUINCY, WASH.—The Wenatchee Valley Gas & Electric Company has asked for a 50-year franchise for the transmission of electricity for light and power purposes. It is understood that work on the building of the line would start within five months and would be completed in less than one year.

SILVERTON, ORE.—The city council has resolved that there be submitted to the legal voters of the city of Silverton at a regular annual election to be held in the said city on the 5th of May, 1913, the question of voting or rejecting a $50,000 bond to purchase and install a municipal electric lighting plant.

SAN RAFAEL, CAL.—Manager Wallace Foster of the Pacific Gas & Electric Company, is making arrangements to extend the gas mains of his company to Sausalito and Mill Valley. The mains are now being laid at Larkspur and Corte Madera. It is the intention of the company to extend the mains to Sausalito first and Mill Valley later.

PORTLAND, ORE.—Mayor Rushlight has received a report from J. H. Cunningham, the engineer who was employed to investigate the cost of a municipal lighting plant. The expert bases his report on the development of a hydro generating plant on the Clackamas River, 12 miles from the city, where rights may be obtained. A plant capable of generating adequate horsepower would cost $2,433,000.

TRANSMISSION.

REDLANDS, CAL.—The city trustees with representatives of the Pacific Electric, Edison, Southwestern Home Telephone, and Western Union and Postal Telegraph Companies, held a conference with reference to the order that all poles in certain streets in the business section be removed by September 1. The companies' representatives are seeking modifications of the order.

RIVERSIDE, CAL.—The city power contracts have been awarded by the board of public utilities to both the Southern California Edison Company and the Southern Sierras Power Company. The Edison company has awarded a contract for power at .85 cent a kilowatt. The Southern Sierras Power Company was iven the contract for supplying all that portion of the city south of Arlington avenue, amounting to about 1000 horsepower, with the privilege of increasing the amount, at 1 cent a kilowatt.

PLACERVILLE, CAL.—Judgment in the foreclosure suit of the Placerville Gold Mining Company for $47,972.25 and interest has been filed against C. N. Beal, the Sierra Water Company, San-Francisco-Oakland Terminal Power Company, subsidiaries of the United Properties Company of California; the Mechanics Trust Company of New Jersey and others. The decree is signed by Judge J. E. Prewett of Placer county, who heard the case February 7th, sitting in the El Dorado county superior court for Judge N. D. Arnot. The property involved consists of the canals and ditches in El Dorado and Amador counties waterworks and water system known as the El Dorado Water & Deep Gravel Mining Company's canal and water system.

TRANSPORTATION.

OAKLAND, CAL.—Suburban electric trains of the Southern Pacific will be running to the western city limits of San Leandro by next June.

EL PASO, TEX.—Permission to build an extension of the electric railway through Piedras street from the Fort Bliss line on the Boulevard to Manhattan Heights, has been asked for by the El Paso Electric Railroad Company, and the extension will begin as soon as a franchise is granted.

OAKLAND, CAL.—The first elevated electric railway in California is that portion of the suburban system of the Southern Pacific which touches the Sixteenth street depot. Work on the approaches to the elevated platform of the new depot has been begun, and is being rushed as fast as possible.

STOCKTON, CAL.—The electrification of the Tidewater & Southern Railway from Stockton to Modesto, a distance of nearly 40 miles, will begin within the coming month. Prior to the beginning of this work the construction of the branch line from Modesto to Turlock will be started. For this work there has arrived over the Western Pacific seven carloads of steel and three of spikes, bolts and angle-bars. Five electric cars ordered by the Tidewater are nearing completion and will be ready for delivery in 90 days. All the electric equipment for the road between Stockton and Modesto has been ordered, and the stringing of wires will soon begin.

SAN FRANCISCO, CAL.—The Board of Public Works has provided for the construction of the ocean extension of the Geary street municipal railway, asking the supervisors to set aside $57,400 of Geary street railway funds to cover the cost of the work. Under the plans now accepted the extension will be built from the present terminus of the city line at Geary street and Thirty-third avenue, southward along the avenue for one block to Balboa street, turning into this and following it westward for eight blocks to Forty-fifth avenue, where another turn southward for a block is to be made to Cabrillo street for the sake of an easier grade. Along Cabrillo street the road will be built to a terminal on the Great Highway overlooking the beach.

SAN JOSE, CAL.—A 50-year franchise for a standard-gauge electric railroad over Alum Rock avenue from the easterly city limits of San Jose to the new San Jose Golf and Country Club, a distance of about five miles, is asked

for in a petition filed with the board of supervisors by F. E. Chapin, general manager of the electric lines in Santa Clara county for the Southern Pacific Company. A narrow-gauge line has been in operation over the same road for more than a quarter of a century, and the Southern Pacific recently completed a new line into Alum Rock Canyon and the city reservation by another road through Berryessa, leaving the present line out. The work on the new line to the golf club, which has just completed its new building and grounds, will begin immediately after the franchise is granted. The railroad would pay 2 per cent of its gross receipts annually to the county, after the first five years, for the franchise.

TELEPHONE AND TELEGRAPH.

LOS ANGELES, CAL.—Permission to issue $100,000 worth of bonds has been granted to the Pomona Valley Telegraph & Telephone Union. The company, which serves Pomona, Chino, Claremont, Lordsburg and San Dimas, intends to use the proceeds for the extension of the system.

SALEM, ORE.—To apply the "common user" principle to the wires of the Pacific and Home telephone companies in the new Oregon Hotel in Portland is the purpose of a complaint filed with the Railroad Commission by the hotel company. It is alleged that the Home company is willing for such co-operation, but the Pacific company absolutely refuses. Each telephone company has a switchboard in the hotel lobby. The complaint points out that the switchboards are located close together and that it would be practically no trouble or extra expense for the calls coming over the wires of one company to be connected up with the instruments of the other company.

OAKLAND, CAL.—While no definite action was decided on at a conference of the city council and representatives of the Pacific States Telephone & Telegraph Company plans calling upon the State Railroad Commission to fix the telephone rates for the coming fiscal year in the bay cities were discussed. John W. Gilkyson, division commercial superintendent of the company, answered all questions put by the councilmen. In answer to a suggestion from Mayor Mott that the business telephone rate be lowered, Gilkyson responded that if this were done the telephone company might install the toll system in the bay cities. This would mean that all calls between Oakland, Berkeley and Alameda and the other nearby communities would cost 6c each. At the present time there is no extra charge for intercity communication.

WATERWORKS.

MILWAUKIE, ORE.—Milwaukie voted in favor of the measure to authorize bonds to the amount of $20,000 to acquire or build a waterworks.

BOISE, IDAHO.—The city council has awarded the contract for the installation of the new lighting system to the Standard Engineering Company of Seattle. The price was fixed at $29,903.

ESCONDIDO, CAL.—The city trustees and directors of the Mutual Water Company are about to agree on a price for the water distributing system owned by the water company, which the city contemplates buying.

REDLANDS, CAL.—Work has commenced on the installation of a new water system and extensions of the old Domestic plant. The system will traverse the principal streets of the business section and residential portion of the city.

FULLERTON, CAL.—The city trustees have awarded the contract for the new city water system to John F. Blair and A. O. Stoval. The proposal of the Fullerton Domestic Water Company to sell its plant to the city at $15,000 was refused by the trustees, being considered too high.

SAN BERNARDINO, CAL.—The water system north of the base line in the northern part of the city is to be greatly improved, and residents in that section will get good water pressure. The 100 inches of water now received from Lytle creek will be diverted through a new pipe line to be built from Campbell to the present main on Highland avenue.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

March 15.

The Sacramento Natural Gas Company has applied for authority to sell $200,000 of bonds, for the purpose of liquidating existing indebtedness for construction purposes.

The Petaluma & Santa Rosa Railway Company applied for authority to issue $80,000 of bonds and $64,000 of notes, the proceeds of which will be used to construct a trolley line from Liberty to Two Rock.

Jonathan Grant Kirkman, of Cuttens, Kern County, and John Alles, of Exeter, Tulare County, joined in an application asking that the former be authorized to lease to the latter the Central Telephone Exchange at Exeter.

March 17.

A decision was rendered granting authority to the Pomona Valley Telephone & Telegraph Union to issue $100,000 of bonds. It proposes to use the proceeds to retire existing bonds and notes, and to extend and improve its system.

The Los Angeles Gas & Electric Corporation applied for authority to issue $900,000 of bonds. The proceeds will be devoted to the purchase of the Valley Gas & Fuel Company, to new equipment and extensions.

The Valley Gas & Fuel Company and the California Coke & Gas Company applied for authority to sell their systems to the Los Angeles Gas & Electric Corporation.

March 18.

Mr. George W. Kitchen filed an application for a certificate of public convenience and necessity to construct a gas plant at Madera.

L. G. Thistle, owner of a telephone company exchange at Mariposa, and the Pacific Telephone & Telegraph Company joined in an application to establish connection at Mariposa.

March 19.

A decision was rendered upon the complaint of James P. Glass, of Del Mar, who asked that the Del Mar Water, Light & Power Company be compelled to furnish service to him. The water company contended that a large outlay of money would be required to supply water to Mr. Glass, whose holdings were upon an elevation. The commission decided that the company should supply water to Mr. Glass; that the company and Mr. Glass should divide the expense of the pipe required for the extension; that the cost of making the connection from this pipe with the property of Mr. Glass should be borne by the plaintiff; and that the maintenance of the extension should be borne by the company.

March 20.

Louis Evans, who conducts a telephone business in the towns of Graham and Tranquility, Fresno County, and the Pacific Telephone & Telegraph Company joined in an application for authority to establish a connection for the interchange of business.

March 21.

The Northern Electric Railway Company applied for an order authorizing the sale of a high-tension transmission line between Nicolaus, Sutter County, and Riego, Placer County, to the Pacific Gas & Electric Company for $11,691.37, plus interest in the sum of $185.09.

The Encanto Mutual Water Company applied for authority to put into effect a rate of 25 cents per thousand gallons, with a minimum charge of $1.50 per month.